KNIFE RIVER

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April 11, 2025

Mr. Vaughn Balzer
Oregon Department of Geology and Mineral Industries
Mined Land Regulation and Reclamation
229 Broadalbin Street SW, Albany, OR 97321

Delivered by email: Vaughn.Balzer@dogami.oregon.gov
Re. Response to Comments, DOGAMI, DEQ, EPA and Revised Sampling Plan

Dear Vaughn,

Knife River is in receipt of your March 5, 2025 comments as they pertain to our proposed Woodward and Vanier sampling plan, which was originally submitted to your office on December 6, 2024. In accordance with your letter and the agency comments contained therein, we have prepared:

Attachment 1: Comment Response Table, which briefly shows how each of these comments have been addressed.

Attachment 2: Knife River Responses to DOGAMI Comments (letter dated March 5, 2025). This attachment provides a far more detailed response from our technical team, which specifically addresses the individual comments.

Attachment 3: "Sampling Plan Vanier Expansion Woodward Mine", Crook County Oregon dated April 11, 2025. This revised sampling plan incorporates changes suggested by Reviewers (EPA, DEQ and/or DOGAMI) as applicable. Where changes have not been incorporated, Knife River's technical basis is summarized in Attachment 1 and expanded in Attachment 2. This Attachment 3 includes:

1. Revised Sampling Plan
2. Revised Figures 1 and 5
3. Revised Tables 1 and 2
4. New Table 3
5. New Appendices A and B

Attachment 3 wholly replaces the December 6, 2024 document. As you will note, there are several areas where we have asked for further clarification and/or technical basis for a comment.. We are happy to discuss these (and/or any) responses in a more informal setting prior to another formal review from your office or DEQ.

If you have any questions or concerns related to this letter or the attachments, please don't hesitate to call.

Best Regards,

Matt Ropp

Matt Ropp, Knife River West Region Technical Services Director

Att: Responses to Comments and Knife River Revised Sampling Plan

Attachment 1

Woodward Site (DOGAMI ID #07-0159)
Groundwater Investigation Plan
Short Form: Responses to DOGAMI Comments dated March 5, 2025

April 11, 2025

Comment Number	Brief Description of Comment	Source	Brief Summary of Knife River Response
1	Cover Letter, Paragraph 2	EPA	Unable to complete request. Data does not support.
2	Cover Letter, Paragraph 3	DEQ	Acknowledged.
3	Cover Letter, Paragraph 4	DEQ	Information included in response.
4	Plan Cover Page	DOGAMI	Acknowledged. Document stamped.
5	Table of Contents, Page i	DEQ	Addressed.
6	Page 1, Section 1, Paragraph 3	EPA	Monthly water level data will be collected for shallow aquifer.
7	Section 2.0	DOGAMI	Table 3 has been created to address comment.
8	Page 2, Section 2.1	EPA/DEQ	Acknowledged and willing to complete backfill well. Need additional information and commitment from Reviewer before we can perform action requested.
9	Page 2, Section 2.1, Paragraph 1	DEQ/DOGAMI	Plan text has been revised.
10	Page 2, Section 2.1, Paragraph 1	EPA	Plan text has been revised.
11	Page 2, Section 2.1, Paragraph 1	DEQ	Plan text has been revised.
12	Page 2, Section 2.1, Paragraph 1	DOGAMI	Plan text has been revised.
13	Page 2, Section 2.1, Paragraph 2	EPA	Boring logs have been added to Sampling Plan (Appendix A).
14	Page 2, Section 2.1, Paragraph 3	DOGAMI	Knife River will provide additional data (3992 and 4144) wells under separate letterhead.
15	Page 2, Section 2.1, Paragraph 2	DEQ	Acknowledged and willing to complete a fourth downgradient monitor well. Need additional information and commitment from Reviewer before we can perform action requested.
16	Page 2, Section 2.1, Paragraph 4	DOGAMI	Knife River does not have legal access to Springs and cannot commit to sample. Knife River replaced WWSP4 with WWSP3.
17	Page 2, Section 2.1, Paragraph 4	EPA	Additional detail provided in response to question.
18	Page 2, Section 2.1, Paragraph 4	EPA	Additional detail provided in response to question and in Sampling Plan.
19	Page 2, Section 2.1, Paragraph 5	DEQ	Agreed and paragraph modified.
20	Page 2, Section 2.2, Paragraph 1	DEQ	Text modified to reflect monthly water level measurements at shallow wells and quarterly water level measurements in deep wells. Water elevation data will be collected for surface water samples.
21	Page 2, Section 2.2, Paragraph 1	EPA	Text has been modified.
22	Page 3, Section 2.2, Paragraph 1	EPA	Additional detail provided in response to question.
23	Page 3, Section 2.2, Paragraph 2	DOGAMI	Table 3 has been created to address comment.
24	Page 3, Section 2.2, Paragraph 2	DEQ/DOGAMI	Comment acknowledged. Knife River does not agree with the request and has requested additional information.
25	Page 3, Section 2.2, Paragraph 3	DEQ	Comment acknowledged. Knife River does not agree with the request and has requested additional information from the Reviewer. As noted before, metal analysis will include dissolved and total.
26	Page 3, Section 2.2, Paragraph 4	DEQ	Comment acknowledged. Knife River will agree to one round of sampling for all shallow wells to include GRO and DRO.
27	Page 3, Section 2.2, Paragraph 4	EPA	Additional detail provided in response to question and in Sampling Plan. Figure 1 has been revised.
28	Page 3, Section 2.3	DOGAMI	Additional detail provided in response to question and in Sampling Plan. Figure 1 has been revised.
29	Page 4, Section 2.4, Protocols	DEQ	Text has been modified.
30	Page 4, Section 2.4, Protocols	DEQ	Text has been modified.

Comment Number	Brief Description of Comment	Source	Brief Summary of Knife River Response
31	Page 4, Section 2.4, Protocols	DEQ	Text has been modified.
32	Page 4, Section 2.4, Paragraph 1	EPA	Appendix B has been added to Sampling Plan.
33	Page 4, Section 2.4, Paragraph 1	EPA	Text has been modified.
34	Page 4, Section 2.4, Bullet 3	EPA	Text has been modified.
35	Page 4, Section 2.4, Bullet 5	EPA/DEQ	Text has been modified and includes discussion on low flow and well purging. Table 3 has been added.
36	Page 4, Section 2.4, Bullet 6	EPA	Text has been modified.
37	Page 4, Section 2.4, Bullet 7	EPA	Text has been modified.
38	Page 4, Section 2.4, Bullet 8	EPA	Text has been modified.
39	Page 5, Section 3	EPA	Comment acknowledged and Section 3 has been added to Sampling Plan.
40	PDF Page 11-12, Table 1	EPA	Footnote added to Table 1.
41	PDF Page 11-12, Table 1	EPA	Error corrected.
42	PDF Page 14, Figure 1	DOGAMI	Comment acknowledged. Site Plan map will be revised once Sampling Plan and Figure 1 are updated and approved.
43	PDF Page 14, Figure 1	DOGAMI	Text and Figure 1 have been modified. Table 3 has been added to Sampling Plan.
44	PDF Page 14, Figure 1	DEQ	Labels have been added to Figure 1.
45	PDF Page 18, Figure 5	DEQ	Water level contours on Figure 5 have been modified.
46	PDF Page 18, Figure 5	EPA	2860 contour left on the map. Contours have been dashed where inferred.
47	PDF Page 18, Figure 5	EPA	Because these wells (Mikulski and Kriege) have been sampled for a number of years, sample names remain. The Mikulski deep well has been clarified as its samples are called 3992-Deep.
48	General Comment	DEQ	Knife River will provide additional data (3992 and 4144) wells under separate letterhead.
49	General Comment	EPA	Additional details have been provided in Sampling Plan.
50	General Comment	EPA	A Conceptual Site Model will be developed when supporting data are available.
51	General Comment	EPA	Comment acknowledged. Knife River does not agree with the request and has requested additional information.

Attachment 2

Agency Comments

1. **Cover Letter, Paragraph 2 (EPA):** Figures 1 through 3 in the Mt. Hood Environmental letter dated August 8, 2024, should be separated into figures showing data from only shallow groundwater and only deeper groundwater. The reviewer is unable to evaluate regional shallow and deep Al and Mn concentrations when the data from both shallow and deep wells are lumped together. All data submittals should be provided in a format that allows the data to be imported into Excel for maximum utility when comparing to other data sets.

   Response*: Figures 1 through **3** cannot be separated to illustrate shallow and deep wells since more than half of the dataset does not have well depth data. The data was sourced from the National Water Quality Monitoring Council. We have also made the data available in .csv format.*

2. **Cover Letter, Paragraph 3 (DEQ)**: Oregon Administrative Rule (OAR) 340-040 requirements were specifically written to prevent groundwater quality contamination from any permitted potential source, not just point sources. This includes any operation that has holding ponds or otherwise discharges process water to the ground or has the potential to impact groundwater quality by interacting directly with groundwater (e.g. through dewatering, infiltration, and mining within the aquifer).

   Response: *OK*

3. **Cover Letter, Paragraph 4 (DEQ)**: The valence states of manganese mentioned in the **Mt. Hood memorandum** is noted as important and related to pH and oxidizing/reducing conditions. The KRC sampling plan includes testing pH, ORP, DO, etc, but does not state how this data will be evaluated. Please include information about how the data gathered under this plan will be evaluated with respect to the valence states of manganese.

   Response: *Valence states of manganese are important in evaluating the geochemistry and movement of manganese in groundwater. However, these same valence states are derived theoretically and are extremely difficult to measure in solution. Generally, they are measured in the solid state as a precipitate and as such are measured in place. The KRC sampling plan and generally all rigorous sampling plans measure pH, EC, Temperature as a standard protocol to ensure that such parameters stabilize before an actual sample is collected. This approach indicates that the water being sampled actually comes from the aquifer and is not simply water that has been sitting in the casing and influenced by extraneous factors. Knife River proposes to measure DO and ORP for the same reasons but not necessarily to characterize the geochemistry or movement of manganese. Specifically, even a low flow sampling program will oxidize the aquifer waters as they are moved from the aquifer or well screen to the top of the well casing and into a sample bottle- even if via tubing into the bottle. DO and ORP have some meaning on surface water samples but likely over emphasize the oxidation state when measured within groundwater. If one were to evaluate the geochemistry (phase equilibria) of manganese, one will understand that manganese goes into solution under lower pH and under reducing (low Eh) conditions. As the water becomes more oxidized (or aerated) manganese begins to precipitate. Similarly, as pH increases (becomes more alkaline), manganese also begins to precipitate. For the reviewer purposes, please reference Hem, 1963 "Chemical*

Equilibrium Affecting the Behavior of Manganese in Natural Waters". Hydrological Sciences Journal 8.3. pp 30-37. For general behavior of constituents review Hem, John 1970. Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water Supply Paper 1473. Washington DC.

4. **Plan Cover Page (DOGAMI):** The cover page for the plan needs to be stamped by an Oregon Registered Geologist. In accordance with the Oregon Revised Statutes (ORS) 672.525 no person, other than a registered geologist, a registered certified specialty geologist or a subordinate under the direction of either, shall provide or prepare for the public practice of geology any geologic maps, plans, reports, or documents except as specifically exempted in ORS 672.535 (Exemptions from ORS 672.505 to 672.705). As such, all work related to the subsurface processes related to groundwater and groundwater movement at the facility falls under the public practice of geology and must be overseen and stamped by an Oregon Registered Geologist.

Response: *Added additional space on the cover page to accommodate a stamp. As a registered geologist in Oregon, Mark Stacy stamped this document prior to its submittal*.

5. **Table of Contents, Page i (DEQ):** There is a typo in the list of figures that needs to be corrected (Figure "1" is missing).

Response: *This has been addressed. A "1" has been added to Figure in the Table of Contents*.

6. **Page 1, Section 1, Paragraph 3 (EPA):** Synoptic water level measurements collected on October 17, 2024, are useful in evaluating groundwater migration pathways at the site; however, groundwater gradients/flow can vary seasonally and over time. The collection of seasonal synoptic groundwater gradients (both vertical and horizontal) should be included in this investigation.

Response: *While groundwater levels will certainly fluctuate during the monitoring period, it will be surprising if flow directions deviate significantly from what has been observed to date as groundwater in shallow aquifers generally mimics surface topography. Local steepening may occur if surface recharge impacts a shallow aquifer but in general neither groundwater flow direction nor pathways are expected to change significantly. For the purposes of this groundwater sampling plan,* ***Figure 5****, which presents the shallow aquifer water table map, acknowledges the October date of the water level measurements. All well heads (TOC and Ground) have been surveyed. This map represents the most recent data set and reflects hydraulic gradient and groundwater flow directions observed at that time.*

The revised text includes a commitment to collect seasonal synoptic water level data. Monthly water level measurements for the first year will capture monthly if not seasonal variations and once plotted will present flow gradient and flow direction. This approach will provide additional data to ensure an accurate and reasonable understanding of flow direction and gradient and the implications of seasonality.

7. **Section 2.0 (DOGAMI):** A clear sampling schedule Table must be included in the plan detailing the proposed sampling frequency for all sample sites noted in the plan. The text in the Table can acknowledge that a reduction in the sampling frequency may be granted by DOGAMI (with DEQ's consensus) provided that data already obtained clearly demonstrates an absence of

operational or seasonal variation and/or that the Woodward site is not causing groundwater pollution.

Response: *A new table (**Table 3**) is presented in the Vanier Expansion and Woodward Sampling Plan. This table includes sampling locations and frequency.*

8. **Page 2, Section 2.1 (EPA and DEQ):** It is our understanding that material was removed below the water table in certain portions of the site. A monitoring well should be installed within a mined and backfilled area to assess groundwater quality and geochemistry/redox in an area where sediment has been disturbed.

Response: *Knife River removed material below the water table in the eastern end of their permit area at Woodward. For your information the DOGAMI operating permit limited mining to a depth of 20 feet below ground surface. In this eastern area, groundwater was encountered above (or shallower) than this depth. Knife River has completed three monitoring wells immediately upgradient of this area to the east and currently has several monitoring wells downgradient of the area to the west.*

Although we believe our proposed monitoring program is adequate to establish impacts, if any to the aquifer, Knife River is willing to complete a monitor well into the backfilled area near the east end of the Woodward site. To ensure that Knife River addresses the reviewer's concerns, we ask that the reviewer(s) please provide an exhibit which identifies: the well location, its depth, screen interval and any other relevant information specific to the completion of this additional well. Knife River requests that the reviewer or a qualified representative of the reviewer's agency be onsite during this well completion effort to ensure that Knife River's registered geologist meets the reviewer's monitor well completion goals. Please let us know in advance who is going to join Knife River's field program and when they will be onsite.

9. **Page 2, Section 2.1, Paragraph 1 (DEQ and DOGAMI):** The terms up gradient and down gradient are not clear. Are these terms with respect to the process water ponds, the existing Woodward site, or the Vanier property? The plan text should be very clear and specific to avoid any confusion.

Response: *The Reviewer should bear in mind that **Figure 5** of the Sampling Plan presents a clear upgradient and downgradient direction for the shallow aquifer for the Woodward and Vanier properties. It is based on shallow aquifer water level measurements taken on October 17, 2024. Historic data, OWRD well logs and literature suggest that the deep aquifer gradient is north to south or perhaps a northwest to southeast component. To substantiate this, Knife River encourages DEQ to collect water level data from the deep aquifer as part of their sampling plan. Although we appreciate receipt of DEQ's most recent data (Maul Foster), we noted that there were no water level measurements within the individual wells to either define depth to water nor volumes of water within the well casing.*

*With respect to the reviewer's comment, the current Sampling Plan characterizes the "upgradient" wells on Page 2, Paragraph 1 as they relate to the Woodward mining disturbance. Knife River has edited this further to characterize the terms "upgradient" and "downgradient" in relation to groundwater flow and mining activities and will call attention to **Figure 5** as well as*

Figure 1. *Upgradient wells are hydrologically upgradient of Knife River's mining activity and downgradient monitor wells are hydrologically downgradient of Knife River's mining activities.*

10. Page 2, Section 2.1, Paragraph 1 (EPA): Please clarify that MW 1-4 is shorthand for MW 1 through MW 4.

Response: *Changed the wording in the text from MW1-4 to clarify that four wells are being referenced.*

11. **Page 2, Section 2.1, Paragraph 1 (DEQ):** MW 7 is listed as one of the upgradient wells, however, it is only upgradient of the settling ponds and not upgradient with respect to the mining that already occurred on the site. Again, the plan text should be very clear and specific to avoid any confusion.

Response: *MW-7 has been removed from this sentence***.**

12. **Page 2, Section 2.1, Paragraph 1 (DOGAMI):** The last two sentences imply a reduction in monitoring for MW 5 and MW 6 which is not consistent with draft DOGAMI permit condition #9 which requires the monitoring to continue for the life of the mine or until DOGAMI and DEQ are satisfied that the mining operation is not having an adverse impact on groundwater quality. Also see comment #7 above.

Response: *In order to avoid confusion, Knife River will commit to sample MW-5 and MW-6 (both downgradient wells) in accordance with permit conditions.*

13. **Page 2, Section 2.1, Paragraph 2 (EPA):** Provide boring logs for wells that are proposed to be included in the sampling plan. At a minimum, boring logs and well development records for newly installed wells (MW 5 and MW 6) should be attached to the document for reference.

Response: *The reviewer shall note that Bob Houston, who is an Oregon registered geologist was present and logged M- 5, MW-6 and MW-7. He also logged a test hole that was completed to a depth of 119 feet. This test hole was drilled to characterize subsurface lithologies, including the depth to the confining bed, which separates the lower confined aquifer from the upper "shallow"/ unconfined aquifer. This test hole was abandoned but provided good information on the stratigraphy of the site. Mr. Houston made the determination for each well completion based on his geologic analysis of the subsurface conditions and lithologies of the shallow aquifer. Similarly, WW-1A, WW-2A and WW-3A were logged by a geologist under the direct supervision of an Oregon registered geologist, Mark Stacy.*

In several cases (MW-5, MW-6 and MW-7), the drillers logs which were filed with OWRD do not agree with the logs prepared by the licensed geologist. It is Knife River's position that the actual lithology is accurately presented by the registered geologist logs and not the drillers logs and the well completion of these wells is justified based on the subsurface hydrogeologic conditions encountered.

MW-1, MW-2, MW-3 and MW-4 were not constructed under the supervision of a licensed geologist and therefore we have only included the OWRD logs. Boring logs and OWRD filings are

*now presented in **Appendix A**. Please note that there are no boring logs or OWRD filings for the Vanier House well or 3320, which is also called the Johnson Well. It is Knife River's understanding that both wells are shallow aquifer wells.*

14. **Page 2, Section 2.1, Paragraph 3 (DOGAMI):** It is noted that samples have been collected from the "3992" and "4144" wells for several years. We have seen a March 8, 2022, email to Crook County (Exhibit 72) from Hudspeth Land+Water with results from the "3992" well but it does not note whether the results are from the shallow or the deep well at that address. Please provide water quality data that has been collected from both the shallow and deep wells at "3992".

Response: *Although these data have been provided previously to various parties, Knife River will provide these data to DOGAMI under separate letterhead.*

15. **Page 2, Section 2.1, Paragraph 2 (DEQ):** MW 5 and MW 6 are identified in the plan as downgradient wells and are the only downgradient wells proposed. Note that DEQ was not consulted as to appropriate locations and/or construction of these monitoring wells prior to drilling. MW 5 is west of the settling ponds and completed in what has been described verbally as unmined land, presumably unmined due to the lack of sufficient gravel in that location. In the well log for MW 5 (55570), the water table was encountered in a "gravel sand" layer at 24 to 42 feet. The well log for MW 6 (55571) showed a similar gravel layer from 24-34 feet, although water in that well was recorded as present from 46 to 62 feet deep. This may have been an error, however, since the groundwater elevation data for those two wells is shown as only 10 feet apart. This potential error is further supported by the driller's static water level measurement of 34 feet at MW 6. This first water and gravel/sand layer would presumably best represent conditions impacted by mining of sand and gravel to depths of 20 feet at the site. However, MW 5 and MW 6 were sealed off from the gravel layers and only screened to obtain water from a deeper zone of sand, silt, and siltstone from 51 or 61 ft (the well log is somewhat unclear) to 71 ft in MW 5 and 52 to 62 feet in MW 6. Since these are the primary downgradient monitoring wells at the site and are possibly not representative of the water bearing zone of interest (the shallow gravel layer), it is recommended that another downgradient well be installed at the SW corner of the Woodward property and screened to obtain water samples from the shallow gravel layer rather than the deeper, silt layer.

Response: *MW- 5 and MW- 6 were drilled and completed in areas that had not been mined previously west and downgradient of the settling ponds. The lithologic logs prepared by Knife River's Registered Geologist and well completion reports for MW-5 and MW-6 have been added to **Appendix A**. The reviewer shall note in our response to Comment 13 that there is a difference in geologic details between our on-site licensed geologist's and the drillers logs. After initially encountering groundwater at a depth of approximately 25 feet, Knife River chose to screen MW-5 at a depth interval of 51 to 61 feet below ground surface through a saturated sand bed in the shallow aquifer. This decision was made based on hydrogeologic considerations and its drilling log is included in the **Appendix A** to the Sampling Plan. After encountering groundwater at a depth of 46 feet, MW-6 was screened at a depth interval of 42 to 52 feet through not only a clayey silt but also underlying sand beds within the shallow aquifer. Again, this decision was made based on hydrogeologic considerations and its drilling log is included in the **Appendix A** to the Sampling Plan. It is important for the reviewer to recognize that the upper aquifer which*

extends from the ground surface to the confining clay bed at 90 feet is "unconfined". Drilling data supports this determination. Although there are intermittent silt and clay beds within the upper zone, such bed/partings are neither continuous nor homogeneous. For the reviewer's information the difference in water level between these two wells (MW-5 and MW-6) based on the October 17, 2024 measurements is 9.8 feet, which is most likely due to the hydraulic gradient observed in the shallow aquifer.

Knife River's technical staff and consultants are neither concerned with the well completions (MW- 5 and MW- 6) nor the ability of these two wells to accurately characterize the downgradient conditions of the Woodward property. It is Knife River's position that the actual boring logs, completed by an Oregon Registered Geologist, support the decision to complete the wells in the manner which they are completed. However, in order to facilitate the approval of this sampling plan, Knife River is willing to install an additional monitor well within this "downgradient area".

To ensure that Knife River addresses DEQ's concerns, we ask that the Reviewer(s) specifically identify: the well location, its depth, completion interval and any other relevant information specific to the completion of this additional well. We request to receive that in writing so that we can provide access to the site and engage a driller to complete this new well. Knife River respectively requests that the Reviewer or a qualified representative of the DEQ be onsite during this well completion effort to ensure that Knife River's registered geologist meets the Reviewer's monitor well completion goals. Please provide that individual's name and contact information so we can coordinate the drilling program.

16. **Page 2, Section 2.1, Paragraph 4 (DOGAMI):** The presence of springs and seeps along the ditch/slough should be noted and sampled if on the mine side of the ditch to the North of the mine, provided Knife River has legal access to do so. It is preferred that the pond 4 water samples not be mixed with makeup water as this would dilute the sample, making the results less useful.

Response*: Currently there is no legal access to allow sampling of the springs and seeps immediately north of the Vanier Expansion area. Should access be approved, Knife River will commit to sampling (and installing a measuring device) at the two springs. In an effort to address the Reviewers commen,t the WWSP-4 sample has been replaced with WWSP-3 (see revised* ***Figure 1****).*

17. **Page 2, Section 2.1, Paragraph 4 (EPA):** Provide additional details on the physical process for adding make-up water to the processing circuit. At what rate is the makeup water added to the processing circuit? Does the rate change based on the source of makeup water? Is makeup water added during the processing (gravel washing) of aggregate at the processing plant? Please record the following information when sampling the water in the process water ponds: Was makeup water being added at the time of sampling? If so, what was the source of that makeup water? If not, how long has it been since makeup water was added and what was the source of that water? Was gravel washing ongoing at the time of sample collection? If not, how long has it been since gravel washing occurred? This information will be useful in understanding results of process water samples.

Response: *Make up water is typically added to the largest pond (Pond 4), which is the cleanest of the process water ponds. Water may also be added to any of the other ponds when needed to*

get them to the proper water level for circulation between the ponds- but generally this occurs as the water circulates between ponds. Make up water is not added at the plant itself. During plant operation make up water is added at a continuous rate of roughly 150 gpm. After weekends, holidays, prolonged shutdowns or at the start of the season ponds are filled at a higher rate, which is dependent on consultation with the OID. Their agreement is based on time of year and irrigation water availability. When Knife River produces make up water from their deep well, they can fill the ponds at a higher rate but again this is generally at a one-time basis when they are filling the ponds. The water right for the production well is 500 gpm. The plant and ponds have been used intermittently in 2025, including 6 days in January, 18 days in February and 8 days in March. The Woodward Plant is not currently operational and Knife River does not have a target date when they anticipate operating again.

The Reviewer's request to record additional items during each sampling event has been noted and added to the Sampling Plan.

18. **Page 2, Section 2.1, Paragraph 4 (EPA):** Describe the process for collecting surface water samples. At what depth will the surface water be sampled? What contextual information will be collected when sampling surface water at the site?

Response: *The paragraph within the sampling document was modified to describe the process for collecting surface water samples, including the sampling depth (30 cm or shallower depending on the depth of the column of water). The sampler will document site conditions (by photograph(s), estimate flow rate where applicable and collect such field parameter data as pH, temperature, turbidity and conductivity. Additionally, the revised paragraph now specifies the use of clean, dedicated equipment to preserve sample integrity and mentions the chain of custody for proper sample tracking. These modifications address the comment regarding the need for a description of the sampling process and contextual information to be collected during surface water sampling.*

19. **Page 2, Section 2.1, Paragraph 5 (DEQ):** It is requested that Sediment samples from the settling ponds be collected from Pond 4 since this pond represents the finest sediment.

Response: *The paragraph was modified to incorporate the request from the Oregon DEQ. It now specifies that sediment samples will be collected from Pond 4 as well as Pond 1.*

20. **Page 2, Section 2.2, Paragraph 1 (DEQ):** Water level measurements are proposed to take place quarterly except at several upgradient wells where they will be measured by pressure transducer. For all wells with continuous water level monitors, calibrate and manually check water levels for the first 3 months, then quarterly. For any wells without transducers, monitor water levels monthly. All wells involved in this study should receive monthly water level measurements – including offsite wells 4144, 3992, 3320, the Vanier house well, and all deep wells. Water elevation data should be collected at the "ditch/slough Water Intake" site quarterly. These data will help to clarify groundwater flow direction.

Response: *Groundwater flow direction is not expected to change significantly during the monitoring period, and it is our technical opinion that quarterly water level measurements will adequately address seasonal influences. Regardless, the paragraph has been modified to incorporate the ODEQ's request for more frequent water level measurements. Water levels will*

*be monitored monthly for all shallow wells shown on **Figure 1** that are without pressure transducers, including offsite wells, 3992 (shallow), 3320, the Vanier house well. Monthly water level measurements for the shallow aquifer will continue for 1 year. After one year Knife River will provide the data and if there is no significant change in gradient or flow pattern, Knife River will petition to suspend monthly water level measurements and continue quarterly measurements.*

With respect to the deep wells, Knife River requests that the reviewer provide the basis for monthly water level measurements of a confined aquifer. Knife River has proposed quarterly (at the time of sampling) water level measurements for the deep wells. Wells with installed continuous monitoring devices (pressure transducers) will be calibrated and manually checked monthly for the first 3 months and then quarterly thereafter.

With regard to surface water sources, water elevation data will be collected quarterly at the "ditch/slough Water Intake" site and the process water ponds to the extent that there is water to sample (as defined by 12 inches of water). The sampler will visit such surface water sites, note site conditions, photograph site conditions and where applicable clarify water flow direction and if make up water is being added to a pond. In an effort to facilitate such water level measurements, Knife River will install and survey staff gages at surface water sampling locations.

21. **Page 2, Section 2.2, Paragraph 1 (EPA):** Synoptic gauging events should be performed before any sampling occurs. Wells should be allowed to equilibrate as needed before gauging. Specify protocol for confirming groundwater elevations have equilibrated before gauging.

Response: *The comment was incorporated into the text by adding a section specifying that synoptic gauging events (depth to water level measurements at all wells) will be performed before any purging and sampling occurs and that wells will be allowed to equilibrate as needed before gauging. Knife River will attempt to gather water levels on domestic or industrial water supply wells at opportune times, but it may not always be practical to obtain static water levels on these wells. Knife River's sampling technician will continue to provide comments accordingly regarding pump operation (status of well use at the time of sampling).*

22. **Page 3, Section 2.2, Paragraph 1 (EPA):** WW1A, 2A, and 3A - Are there notable changes in hydrostratigraphy or well properties at these locations? An area with higher groundwater flow rates (~100 gallons per minute) was observed during test pit advancement at the Vanier property (Stantec, 2021). How do these wells relate in terms of yield? If one well is significantly different in stratigraphy or yield, we recommend sampling that well in addition to one other.

Response: *No. The completion reports for these wells have been included in the sampling plan. The revised text adds details about the proximity, elevation, depths, and screened intervals of WW-1A, WW-2A, and WW-3A to clarify their hydrogeologic similarities. The revised text supports the Knife River decision to only sample WW-2A. The three wells are located within 100 feet of each other and were completed in this fashion to allow for proper analysis (multi well aquifer test) of the shallow aquifer. The drilling, lithologic and aquifer test data all support that these wells are characteristic of the same upgradient location (upgradient to the Woodward Mine disturbance) and the same aquifer. There is no difference between any of the wells in either*

stratigraphy, position within the Study Area or aquifer characteristics. These same three wells are also downgradient of the proposed Vanier mining area.

23. **Page 3, Section 2.2, Paragraph 2 (DOGAMI):** The specific wells/surface water samples that are proposed to be sampled should be listed explicitly to avoid misunderstandings going forward. A table listing all the sample locations with the sampling frequency should be included. The table should include a statement that sampling will continue until DOGAMI and DEQ are satisfied and provides relief to Knife River in writing. Also see Comment #7.

Response: *Added **Table 3** to clearly state sampling locations and sampling frequency. Also referenced this table in Section 2.2. A statement that sampling will continue until DEQ and DOGAMI provide relief to Knife River in writing has been added to **Table 3**.*

24. **Page 3, Section 2.2, Paragraph 2 (DEQ and DOGAMI):** The plan suggests quarterly sampling. DOGAMI and DEQ believe seasonality may play a key role in manganese fate and transport. Therefore, monthly sampling is required for groundwater sampled under the proposed plan to most appropriately capture any seasonality on the data and to detect potential water quality changes due to irrigation, pumping, rainfall, and activity at the mine. If mine activity is expected to be varied and intermittent, it will be important to document when and what mine activity (mining, refilling pits, washing, dredging of the ponds) takes place in relation to sampling dates.

Response: *Knife River concurs that seasonality should be considered in manganese fate and transport within the shallow aquifer and for that reason has proposed quarterly sampling. Although seasonality is likely not a factor in manganese levels related to the deep aquifer, Knife River has proposed to collect quarterly data from the deep aquifer wells. Knife River's technical team cannot support the concept that monthly water quality sampling is justified- either for the deep or shallow aquifer. With respect to the reviewers' comment, we petition the reviewer to provide a technical basis for such an increase in sampling frequency. The reviewer provides limited information in their comment and suggests the rationale for monthly sampling is: "to most appropriately capture any seasonality on the data and to detect potential water quality changes due to irrigation, pumping, rainfall, and activity at the mine."*

*Specifically, metal transport through the unsaturated zone is not linear and is generally characterized by Eh and pH conditions of the meteoric waters**.** Irrigation season lasts between April and October and quarterly sampling allows Knife River to collect a minimum of two water quality samples during the irrigation season. The reviewer's reference to pumping is unclear and if related to "makeup water" seasonality is not a factor**.** With respect to "rainfall", effective precipitation is defined as the amount of rainfall that actually recharges the groundwater and percolates past the root zone of plants. Such rainfall in the Crook County area is minimal and is generally characterized when the area soils are at or exceed Field Capacity. This generally occurs over a six-week period each year and likely occurs in April or May. Quarterly sampling will capture this period. No mining is taking place at Woodward and given the lack of mining activity and its lack of variability, quarterly sampling provides sufficient information to address this activity. It is our technical opinion that quarterly sampling for both groundwater and surface water is appropriate.*

25. **Page 3, Section 2.2, Paragraph 3 (DEQ):** A flow cell should be used for field parameters – DO, ORP, pH. Analyte List: KR's analyte data should include parameters shown to be of concern by recent MFA domestic well testing data. As such, following analytes should be added to the KRC analyte list on page 3 of the December 2024 Sampling Plan: As, Cu, Sulfur, Ammonia, Fluoride, Sodium, Turbidity, and analysis of multivalent Mn and Fe. For the metals, the lab should analyze for both total and dissolved fractions.

Response: *Knife River request clarification of the basis for the addition of such analytes as noted above. They also need clarification of the Reviewers proposal to sample for sulfur (elemental sulfur) versus sulfate. To the best of our knowledge, there is no common (EPA approved) laboratory procedure to analyze for sulfur in water. Analysis can include sulfate and perhaps H2S (sulfide form of sulfur). Several of these other (including sulfur) parameters cannot be construed as mining related.*

The text of the sampling plan was revised to clarify field parameter measurements including turbidity, DO, ORP, and pH, along with any other field parameters measured during purging and sampling. Knife River has agreed and will continue to sample for total and dissolved metals and had previously agreed to add As to the sampling plan. Additional analytes, including copper, sulfate, ammonia, fluoride, and sodium do not appear to have a mining source and we request clarification on the Reviewers request. With regard to the analysis of multivalent iron and manganese, we request the Reviewer provide us: (1) an acceptable EPA approved laboratory procedure for these sample analyses; (2) names of a laboratory that can complete this procedure; and (3) the technical basis for this request.

26. **Page 3, Section 2.2, Paragraph 4 (DEQ):** DEQ agrees that GRO and DRO testing will be a good addition to the analyte list due to the potential for oil and gas drips/leaks from site equipment. These analytes should be included for all samples, not just samples from upgradient wells.

Response: *Knife River has agreed to add GRO and DRO to the general analyte list for wells completed in the shallow aquifer in the vicinity of the Vanier property. The decision to add these parameters and the resultant land use condition that is cited in the Sampling Plan was based on Knife River's proposal to operate equipment in the subsurface (below existing ground level and in a dewatered mine pit). Mining is completed within the Woodward area and there is no record of equipment spills. In addition, all Knife River employees are required to inspect equipment before they begin work every morning and address equipment leaks or problems in advance of operating that piece of equipment.*

In an effort to address this comment Knife River proposes to monitor all shallow water wells for GRO and DRO on a one-time basis. As noted in their Sampling Plan, Knife River will collect GRO and DRO data from the Vanier monitor wells MW-1, MW-2, MW-3, MW-4, and WW-2A- quarterly for one year. Given the confined character of the deep aquifer, Knife River's surface activities will not have any impact on the deep aquifer and neither GRO or DRO data will be collected.

In summary, Knife River proposes to sample monitor wells completed in the shallow aquifer for these two analytes during one sampling round. In accordance with their land use condition, they will continue to sample the Vanier wells for these two parameters on a quarterly basis for one year to establish baseline conditions. Once mining commences within Vanier, quarterly

sampling frequency will continue. If GRO or DRO is detected in any well, Knife River will conduct follow-up sampling for the appropriate parameter within a month of receiving sample results.

27. **Page 3, Section 2.2, Paragraph 4 (EPA):** Soil samples - Additional details on soil sampling locations and sediment sampling procedures need to be provided for review and comment. Show proposed soil sample locations on figures.

Response*: Soil sampling locations have been identified on* ***Figure 1****, The text of the sampling plan has been modified to identify soil sampling procedures. Soil samples will include samples collected from sludge at the bottom of Process Water Ponds 1 (Sed 1) and 4 (Sed 2) and a sample from the irrigation intake (Sed 3). These samples will be collected using a California Tube pushed into the sludge until refusal is encountered. Each sample will be capped and sealed and delivered to the laboratory. The two remaining samples will be collected from Woodward reclaim and Vanier native soils. These latter two samples (Sed 4 and Sed 5) will be collected at a depth of 12 to 15 inches and/or below the organic horizon. These samples will be placed in a Ziploc bag, labelled, and delivered to the laboratory.*

28. **Page 3, Section 2.3 (DOGAMI):** Collecting sediment samples from the process water pond as well as two upgradient soil samples from mining operations is referenced. The location of the two upgradient soil samples for analyses should be identified on Figure 1 of the plan.

Response: *Soil sampling locations have been added to* ***Figure 1***.

29. **Page 4, Section 2.4, Protocols (DEQ):** Field notes should include weather, recent heavy rains, adjacent lands irrigation, standing water on site, recent site activity, etc.

Response: *The text was modified to expand the field documentation of site conditions It now includes weather conditions, recent heavy rainfall, adjacent land irrigation, standing water onsite, and recent site activities while maintaining existing details on vandalism, access issues, water use, and well operation.*

30. **Page 4, Section 2.4, Protocols (DEQ):** Metals should be preserved in the field and checked to ensure preservation to a pH of 2 or below. Field filtration of samples is best practice.

Response: *The plan has been modified to include a statement that metals samples will be field filtered and preserved. Samplers will coordinate with the lab to ensure the appropriate sampling procedure is followed.*

31. **Page 4, Section 2.4, Protocols (DEQ):** The plan does not include the required Data Analysis Procedure (statistical analysis method and frequency of data analysis) as required by the rule (See OAR 340-040-0030(2)). A key component of the plan is not just the collection of the data, but the analysis performed in order to determine potential impacts from site operations or the lack thereof.

Response: *Potential impacts on groundwater quality will be quantified by comparing manganese concentrations collected at upgradient background wells with those from potentially impacted wells downgradient of facility operations. This interwell analysis will be conducted using a one-way analysis of variance (ANOVA) to determine if there are statistically significant differences in manganese concentrations (mg/L) between samples from background and potentially impacted wells ($\alpha = 0.05$). The one-way ANOVA approach was chosen for*

efficiency in retaining degrees of freedom compared to more complex methods, thereby providing greater statistical power to accurately quantify variance and ensure reliable results. Analyses and data visualizations will be conducted using the statistical program R (R Core Team 2024). The frequency of analysis will repeat quarterly to align with ongoing sample collection intervals.

Because a confining layer separates the shallow and deep aquifers, this analysis will focus on monitoring wells that draw groundwater from the uppermost (shallow) aquifer, which is more likely to be affected by site activities. For this analysis, shallow wells are defined as those less than 75 feet deep. The background wells include MW-1 and MW-2, as well as the Vanier House Well, which is located upgradient (Wenck 2021; water table map 2024). These wells are located approximately 1,500 feet northwest of the Woodward property line and about 3,000 feet upgradient from formerly active mining operations. The immediately downgradient shallow wells (MW-5, MW-6, and MW-7) are also situated on the Woodward Site. Another cluster of shallow wells exist outside the permit area and include CRO 953 (Elbek), CRO 939 (Porfily) and CRO 948 (McCormick). These three wells shall be analyzed in a third group. These wells were sampled by MFA one time and Knife River recommends that DEQ sample them quarterly in conjunction with Knife River's sampling program. If landowner consent could be obtained, Knife River could add these three wells into their sampling program.

Source: R Core Team. 2024. R: A language and environment for statistical computing. R foundation for statistical computing. Vienna, Austria; Wenck. 2021. Woodward/Vanier aggregate mine hydrogeologic characterization. Prepared for Knife River Corporation. Maul Foster Along, 2025. Prepared for Oregon DEQ February 2025.

32. **Page 4, Section 2.4, Paragraph 1 (EPA):** List proposed laboratories and provide certifications.

Response: Knife River has c*reated **Appendix B** to list proposed approved labs and their certifications*.

33. **Page 4, Section 2.4, Paragraph 1 (EPA):** Specify equipment that will be used for purging/sampling and discuss decontamination procedures.

Response*: Changes have been made in the Sampling Plan text to discuss the equipment used for purging and sampling. Sampling pumps include either a dedicated or temporarily installed submersible pump for purging/sampling along with potentially a peristaltic pump for field filtration. Additionally, decontamination procedures were explicitly outlined, stating that any equipment used on different wells will be cleaned between wells using an Alconox and distilled water solution. These additions ensure clarity on the sampling process and compliance with best practices for preventing cross-contamination.*

34. **Page 4, Section 2.4, Bullet 3 (EPA):** Sampler should also allow for water levels in non-pumping wells to equilibrate following the removal of well caps. This is especially important in the deeper wells that are screened in the confined aquifer.

Response: *The Sampling Plan has been revised to specify that water levels in non-pumping wells equilibrate following the removal of the well cap. Stability will be defined as of less than 0.05 feet in three successive measurements.*

35. **Page 4, Section 2.4, Bullet 5 (EPA and DEQ):** State what depth within the well screen samples will be collected (middle? bottom?). For monitoring wells - Efforts should be made to mitigate drawdown during sampling so that the groundwater conditions are not altered. Drawing down the water column can introduce conditions (e.g., oxygen) that are not representative of the formation. Please refer to EPA low flow sampling procedures (https://www.epa.gov/sites/default/files/2015-06/documents/lwflw2a.pdf). For low flow (250 mg/min-500 ml/min) methods of purging and sampling of shallow depth wells, field parameters should be measured until stabilization indicates that aquifer water is being accessed; this may reduce the amount of purge time required, potentially reduce disturbance of the formation (and TSS/TDS concentrations) and would greatly improve the representative quality of the samples collected. This would be preferable to purging the well first at a higher flow rate and then switching to a low flow rate for sampling, or sampling at a high flow rate.

Response: *The shallow and deeper aquifers at the Woodward Mine are not low yielding aquifer settings. Both methodologies (three casing volume and low flow purge methods) are acceptable EPA protocols for collecting representative groundwater samples for metals (Mn, Fe, Al). In an effort to address the Reviewer's comment, Knife River will incorporate both the three casing volumes purging method with parameter stabilization and low flow purging techniques based on the well type and presence of existing pumping equipment.*

*The purging method to be used for each respective well is identified on **Table 3**. For any well not equipped with dedicated pumping equipment, at least one casing volume will be purged with the pump set in the middle of the screen before sampling under the low flow purging method. Any production or domestic water supply well with dedicated pumping equipment will be purged and sampled using the existing pumping equipment with the pump intake set at its current depth. Under both purging approaches, water quality parameters will be monitored throughout the purging process to identify when water quality parameters have stabilized and representative aquifer water is being discharged. The revised procedure acknowledges the importance of minimizing drawdown in monitoring wells (<0.3 feet, ideally) regardless of the pumping rate used for purging.*

Specifically, Knife River commits that during one sampling round, they will test the applicability of each procedure. Four monitor wells (MW-2, MW-5, MW-6, and MW-7) will be purged and sampled using both purge methods to compare analytical results and thereby determine if there is any significant difference in analytical results based on each respective method. Analytical parameters will be in accordance with the approved Knife River sampling plan. The purging and sampling of these wells using the two different methods would be completed on two different days. Should a significant difference be determined, Knife River will discuss the difference with DEQ and identify the most applicable and representative protocol for sampling all wells without dedicated pumping equipment.

36. **Page 4, Section 2.4, Bullet 6 (EPA):** Include water level, dissolved oxygen (DO), and Oxidation Reduction Potential (ORP) on the list of field parameter measurements. Discuss what conditions are indicative of "stable" field parameter measurements.

Response: *The sampling plan has been modified to include what conditions define stabilization of field parameters. Water level, pH, temperature and conductivity are clear indicators of stable*

field parameters. With respect to those indicators, three successive readings should be within 0.3 feet in water level, ± 0.5 s.u. for pH, 0.2 degrees Celsius in temperature and ± 3% for conductivity. The sampler will record redox, turbidity and dissolved oxygen and will consider the relative stability of these parameters (repeatability) prior to sampling.

37. **Page 4, Section 2.4, Bullet 7 (EPA):** Sampling is not well development - remove "and, in her opinion, the well is adequately developed".

Response: *Deleted language mentioning well development.*

38. **Page 4, Section 2.4, Bullet 8 (EPA):** Record water level at the end of purging, efforts should be made to demonstrate that minimal drawdown has occurred throughout the purging process.

Response: *Added language directing samplers to record a final water level. Minimizing drawdown during purging/pumping is mentioned in the well purging procedure.*

39. **Page 5, Section 3 (EPA):** Discuss how data will be evaluated and reported. Commit to a schedule for reporting and summarize report contents. Reporting should include a conceptual site model (CSM) that compiles and presents existing data in addition to data collected during investigation activities. Additional mobilizations may be necessary to address data gaps identified following the comprehensive review of the CSM.

Response: *The Woodward Mine has not been identified as a contaminated site, and no technical data supports a point or diffuse source associated with Knife River's aggregate removal or processing activities. The Reviewer will not find this site noted on EPA's Cleanups in my Community webpage. Knife River understands local water quality concerns and is working to understand how and why manganese is present in certain domestic wells and not present in other domestic wells. Current geologic data suggests that metalliferous conditions within the lower aquifer are unrelated to any surface activities including mining. The Reviewer shall also be aware that public water systems (PWS) in the immediate area of the Woodward property do not publicly report manganese. On a regional basis, one PWS, which did report manganese levels in their water system, provided no public follow up after their sampling event.*

A Conceptual Site Model (CSM) has not been created for the shallow aquifer. It is anticipated that additional data collection by Knife River and DEQ may allow for additional site characterization and the development of a CSM. Statistical analysis is discussed in Comment 31. Given the limited information related to downgradient wells, regular sampling of several shallow downgradient domestic wells will improve the understanding of manganese levels. Knife River proposes that DEQ coordinate sampling events for CROO 948 (McCormick), CROO 939 (Porfily) and CROO 953 (Elbek) to ensure timing and seasonality of the data.

Section 3.0 has been added to the Sampling Plan to address this comment. This section outlines data collection, validation, and analysis methods, with findings informing a CSM. The CSM typically focuses on understanding how point source contaminants move from source to human exposure. The manganese concentrations that have been identified to date by Knife River and others have not indicated the characteristics of point source contamination. Knife River will provide annual reports that summarize analytical results, highlight trends, provide any statistical analysis as appropriate and include regulatory comparisons. As data become

available and following each level of analysis, the CSM will be developed and presented with the annual reports. This information and CSM will be updated as appropriate. The annual reporting will also identify data gaps and suggest means to address such data gaps.

40. **PDF Page 11-12, Table 1 (EPA):** Provide more context for column headings. Depth to first water – is this during drilling? Was depth measured in ft bgs?

Response: *Added a footnote to the table describing that "first water" indicates the first observable water noted during drilling and/or well installation based generally on OWRD well logs.*

41. **PDF Page 11-12, Table 1 (EPA):** It should be noted that groundwater elevations are the same (2902.1') for both the shallow (30-50') and deep (266- 281') wells located on 3992 NW Stahancyk Ln. Please check if this is a transcription error or real data. If these measurements are correct, there may be a connection between the shallow and deep aquifers in this location.

Response: *This was a transcription error. The correct water level at the deep Mikulski well is 2885.5 and is not 2902.1.*

42. **PDF Page 14, Figure 1 (DOGAMI):** This figure is not consistent with the site plan map circulated as part of the DOGAMI application process with respect to the location and names of MW 5, and MW 7. DOGAMI will require Knife River to revise their site plan map for the DOGAMI permit to be consistent with this plan and figure. DOGAMI can then change the permit condition references to the monitoring wells to be consistent with the revised site plan map and this map (Figure 1) before issuing a final permit.

Response: *This comment is understood. Given the process involved to get the Sampling Plan approved, Knife River suggests that this map be updated once the Sampling Plan is approved.*

43. **PDF Page 14, Figure 1 (DOGAMI):** The legend includes "Additional Monitoring Wells" which appear to be WW-1A, and WW-3A. Please clarify that these "Additional Monitoring Wells" are not proposed to be sampled or monitored under this plan on the figure. Figure 1 should also reference the new sampling frequency table (see Comment # 7 above) listing all monitoring wells, and sample sites and the parameters that will be sampled.

Response: *WW-1A and WW-3A are included in the plan for reference but are not included in the Sampling Plan. Notes have been added to the figure to clarify this and is further addressed on* ***Table 3****, which confirms sampling frequency.*

44. **PDF Page 14, Figure 1 (DEQ):** Add labels with the pond numbers on Figure 1 for clarity.

Response: *Labels have been added to the process water ponds on* ***Figure 1****.*

45. **PDF Page 18, Figure 5 (DEQ):** Groundwater gradient. The groundwater gradient appears fairly flat in the Vanier section of the property so it is difficult to tell if the offsite wells are truly cross gradient or somewhat downgradient. Contours should not be extended past the ditch/slough unless there is data supporting that. The series of wells WW-3A, 2A, 1A and MW 4 and 3992 indicate a southern groundwater flow direction in that vicinity which may be influenced by the creek.

Response: *The water level contours have been modified such that they do not extend past the ditch/slough.*

46. **PDF Page 18, Figure 5 (EPA):** Remove 2860-foot contour and dash contours that are inferred.

Response: *The 2860-foot contour has been left on the map, and all water level contours have been dashed. This is our best picture of what groundwater flow conditions look like for now.*

47. **PDF Page 18, Figure 5 (EPA):** Well ID for 3992 does not correspond to well IDs on Table 1. Please provide consistent names/well IDs on both figures and tables. 3992 is an address, but the well ID should be included in the name to avoid confusion.

Response: *Because there are two wells at Mikulski and these wells have been sampled for a number of years, sample names have been changed. The shallow and active well is identified as 3992. The deep well is identified as 3992-Deep***.** *This is identified on* ***Figure 1*** *and* ***Table 1*** *and* ***Table 3****.*

48. **General Comment (DEQ):** Table 1 and 2 on pages 9 and 10 of the pdf "KR Woodward Exhibit" report (Memorandum dated 12-23-24 "Fourth Quarter 2024 Sampling Woodward and Vanier" mention that Mn data was collected from March to October 2024, but only one value is reported per well. Since we are interested in seasonal variation, a more comprehensive table reporting DTW and Mn results during that period would be useful.

Response: *In general water quality data for all the wells are available for October 2024. Before this date, water quality data are only available for a couple of the wells: MW1 and MW2 (August 2024) and as previously noted Mikulski and Kriege wells. Under separate letterhead, Knife River will compile historic data as it pertains to Knife River's overall well sampling program.*

49. **General Comment (EPA):** Provide standard operating procedures (SOPs) or additional details for how (methods/equipment) and where (location/depth) samples will be collected and analyzed (Quality Assurance Project Plan [QAPP]). Sample collection methods should be consistent with ODEQ so that results are comparable across sampling programs.

Response: *Additional details on the methods and equipment used have been included in the Sampling and Analysis Plan. Our responses to comments 33 and 35 further address these issues.*

50. **General Comment (EPA):** Field investigation should include an evaluation of groundwater flow/contaminant flux across the site. High groundwater flow rates in the shallow aquifer (~100 gpm) were observed during test pit advancement at the site. Efforts should be made to understand the site conditions that are contributing to the increased groundwater flow in this portion of the site. Generally, groundwater yield is higher in the deeper aquifer. Could there be a connection to the deeper aquifer in this area (e.g., improperly abandoned well) that is resulting in higher flow and possibly higher Mn concentrations? Could there be a buried channel with different yield/characteristics in the portion of the site? A conceptual site model (CSM) should be developed following sampling and investigation to summarize conditions at the site.

Response: *Stantec completed a local hydrogeologic investigation in the area with the high observed groundwater flow in 2021 and will develop an estimate of groundwater flow/contaminant flux across the site. In response to this comment, we have revised the sampling plan to include an evaluation of the factors contributing to the visually observed high groundwater flow in the shallow aquifer, specifically in areas where Knife River visually estimated high inflow rates as discussed in Section 3.0 (2021 Stantec report). Our conceptual site model (CSM) will consider this and once developed we will summarize and interpret the findings related to groundwater flow and contaminant transport at the site detailed in Section 2.1 and 2.5. Any CSM model will be complicated by the fact that no site-specific baseline water quality data were collected prior to mining and historic data suggests manganese "hot spots" in the general area of the mine*

51. **General Comment (EPA):** Vertical soil and groundwater profiling adjacent to the mined area should be performed to: 1) evaluate where the highest concentrations of Mn and Al are present within/above the shallow aquifer, and 2) compare those findings to mining operations/depths and local well screen elevations.

Response: *The reviewer's comment is not clear. Please explain your rationale for not only requesting this type of profiling and provide more specifics related to what you propose. Knife Rive does not propose any vertical soil and groundwater profiling and technically questions the validity of such an effort. We have proposed water sampling from various monitor wells completed in two aquifers within the general area: the shallow and deep aquifers. There is a thick confining layer between the two aquifers. One would not expect stratification of manganese in the column of water in either aquifer. With respect to soil sampling there is no basis nor is there sufficient "effective" precipitation to characterize vertical movement of manganese within the soils. Please provide further explanation and technical basis to your request.*

Attachment 3

Sampling Plan
Vanier Expansion
Woodward Mine

Crook County, Oregon

Prepared for:
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Prineville, Oregon

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April 11, 2025

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1.0 INTRODUCTION

As outlined here, Knife River intends to collect samples from both groundwater and surface water sites located on or adjacent to the mining and proposed expansion area for at least one year. With regard to groundwater, our plan is to sample 17 shallow and deep aquifer wells quarterly to assess manganese (Mn), aluminum (Al), and iron (Fe) concentrations. In a similar fashion, Knife River will sample surface water sites quarterly, including at least five sites similarly identified on **Figure 1**.

The mining facility at Woodward and Vanier is underlain by two aquifers: a shallow aquifer and a deep aquifer. The shallow aquifer exists within the unconsolidated sands, silty sands and gravels that extend from the land surface to depths of approximately 50 to 70 feet. This aquifer is unconfined and was encountered as mining progressed toward the east end of the Woodward property. The majority of the mining at Woodward was "dry mining" and the groundwater table was not encountered. Below the shallow aquifer is a thick impermeable bed of clay or silt that ranges in thickness from approximately 110 to 160 feet. This clay layer serves as a confining bed and based on local pumping and potentiometric surface information, isolates the shallow aquifer from the deep aquifer. The stratigraphic top of this lower aquifer ranges from 200 to 230 feet below ground surface, and the permeable beds range in thickness from 30 to 50 feet. The geologic relationships of the shallow and deep aquifers below the mining facility are illustrated by the geologic cross sections presented on **Figures 2, 3**, and **4**. These geologic cross sections were prepared from well completion reports on file with the Oregon Water Resources Department.

Knife River has identified the groundwater flow direction in the shallow aquifer based on monitoring wells they completed at the mining facility. As shown in **Figure 5** and based on the most recent water level measurements collected on October 17, 2024, groundwater in the shallow aquifer flows west and southwest across the mine site. These water level measurements were obtained from the monitoring wells installed at the mine since 2021, as well as one neighboring shallow aquifer well. Completion details for all the wells that Knife River plans to monitor are provided in **Tables 1** and **2**. Borehole logs and well completion data for the Knife River monitoring wells are included in **Appendix A**. While October 17, 2024 data are valuable for assessing groundwater flow paths, Knife River recognizes that the static water level within an unconfined aquifer may fluctuate seasonally and over time. To assess these potential variations, monthly water level measurements will be taken for wells completed in the unconfined aquifer for one year to better capture seasonal changes in hydraulic gradients and flow directions. Based on these data, Knife River will likely petition to reduce the monthly water level data collection to quarterly after one year. The data from October 2024 and **Figure 5** serve as an illustrative planning tool for this sampling plan. A detailed overview of the sampling locations and proposed frequencies for groundwater, surface water, and sediment/soil monitoring is provided in **Table 3**.

In addition to the wells referenced herein, Knife River is willing to add two additional wells to the sampling plan based on direction from the Oregon Department of Environmental Quality (DEQ) and Department of Geology and Mineral Industries (DOGAMI). One of the monitoring wells may be completed into the backfill (or reclaimed mine pit) near the east end of the Woodward site. The other monitoring well may be completed west of Knife River's processing ponds. Knife River is waiting for written guidance from DEQ and DOGAMI on the selected location and proposed construction details for these two wells prior to scheduling the well construction effort.

2.0 SAMPLING PLAN

2.1 Sampling Locations

Knife River is planning to sample shallow aquifer wells across the mining facility and based on the shallow aquifer water table map in **Figure 5**, has identified their hydrogeologic position relative to the Woodward Mine. For clarity, "upgradient" refers to wells located hydrologically upstream of mining activities at Woodward, while "downgradient" refers to wells positioned downstream of mining activities at Woodward. Within this area, some references to gradient position are noted with reference to the local area. **Table 3** summarizes the proposed groundwater and surface water sampling plan, detailing the sampling locations and the recommended sampling frequency based on feedback from DOGAMI and Oregon DEQ.

The upgradient shallow aquifer wells, relative to the Woodward mine-related disturbance, are located east of the site, as shown on **Figure 1**. These upgradient wells include MW-1, MW-2, MW-3, MW-4, WW-2A, and the Vanier House Well. Although MW-7 is upgradient of the processing ponds, it is not upgradient relative to the mining activities that have already taken place at Woodward. Once the Vanier application is approved and mining begins in the Vanier Expansion Area, the designated upgradient wells will continue to include MW-1, MW-2, and the Vanier House Well. Knife River also proposes to continue monitoring select cross-gradient shallow aquifer residential wells, including MW-3, MW-4, the Mikulski well (3992) and the Johnson well (3320), to further assess groundwater conditions in the area.

With respect to the three wells downgradient of Vanier and upgradient of Woodward (identified as WW-1A, WW-2A and WW-3A), Knife River proposes to sample only one (WW-2A) until site conditions dictate a change in sampling protocol. Such site conditions may include, but are not limited to, a significant change in water level, water chemistry, temperature or field parameters. The three wells drilled in 2021—WW-1A, WW-2A, and WW-3A—are within 100 feet of each, all completed in the shallow aquifer, with minor elevation differences (ranging from 2928 to 2930 feet), and similar lithologic and well construction characteristics. WW-1A extends to 30 feet below ground surface (bgs) (screened 10 to 30 feet), WW-2A extends to 25 feet bgs (screened 10 to 25 feet), and WW-3A extends to 28 feet bgs (screened 13 to 28 feet). The well completion reports for these wells are included in **Appendix A**. Given these similarities and the minimal drawdown observed at WW-2A during aquifer testing, only WW-2A will be sampled to represent groundwater conditions in this area.

West of the disturbance area at the mine, the downgradient shallow aquifer wells consist of MW-5 and MW-6. Both wells are situated downgradient from the Process Water Ponds and the Woodward mining operation. Both wells were completed in September 2024 to depths between 62 and 71 feet. Although these two wells (MW-5 and MW-6) represent downgradient site conditions, no baseline data was collected on the shallow aquifer in this area before the mining and processing at Woodward commenced. The samples collected from these wells only reflect current site conditions and do not reflect compliance points where one can compare the current results to an undisturbed baseline. These two wells, MW-5 and MW-6, will continue to be sampled in accordance with permit conditions. In addition to these two wells MW-7, which is a shallow well downgradient from the majority of mining at Woodward will be sampled. This well is also located upgradient of the Process Water Ponds and adjacent to the deep aquifer well identified as the Production Well.

In addition, Knife River is planning to sample several deep aquifer wells, shown on **Figure 1**, at or immediately adjacent to the property, including the Production Well, the Woodward Shop Well, the Mikulski Deep Well (3992-Deep), and the Kriege Deep Well (4144). Knife River has been sampling the Mikulski and Kriege wells since 2016, prior to the beginning of Woodward Mine operations.

As requested by DOGAMI and shown in **Figure 1**, Knife River proposes to sample several surface water bodies, including: Knife River's Process Water Ponds; Knife River's Water Intake near the ditch/slough; and Standing Water within the last unreclaimed mine cell (if applicable) on the Woodward property. Surface water will be sampled from the water's surface to a depth of 30 centimeters (or shallower depending upon the water depth) to the extent that water is available at the time of sampling, following Environmental Protection Agency (EPA) standard procedures (EPA, 1983). At the time of sampling, the sampler will document site conditions with photographs, including water clarity, weather, flow rate, pH, temperature, turbidity, and electrical conductivity. Sample integrity will be preserved by using clean, dedicated equipment, and samples will be properly documented on a Chain of Custody form. With regard to the process water ponds, Knife River will sample these ponds at two locations: Pond 1 (WWSP-1), which generally receives "first" water from the processing plant, and Pond 3 (WWSP-3). All surface water sources, including the process water ponds, will be sampled to the extent that there is water available to sample (at least 12 inches of water must be present in the respective pond). At the time of sampling, the sampler will document site conditions, including whether makeup water was being added at the time of sampling, makeup water source, how long it has been since makeup water was added and last source of water, whether gravel processing was ongoing during sample collection or if not how long it has been since gravel processing occurred, flow rate, pH, temperature, and other relevant parameters.

With regard to the source of process/makeup water, it is important to note that during the irrigation season, makeup water generally comes from the Water Intake (**Figure 1**), and during the remainder of the year, makeup water is produced from the Production Well (**Figure 1**). The Woodward Processing Plant is not currently operational, and Knife River does not have a target date when they anticipate operating again. When in operation, make up water is typically added to the largest pond (Pond 4). Water may also be added to any of the other ponds when needed to get them to the proper water level for circulation between the ponds but generally the ponds tend to equilibrate during normal plant operations. During plant operation make up water is added, generally at a rate of 150 gallons per minute (gpm). After weekends, holidays, prolonged shutdowns or at the start of the season ponds are filled at a higher rate, which is dependent on a rate agreed to by the Ochoco Irrigation District and their agreement is based on availability. When Knife River sources "make up" water from their deep aquifer well (Production Well), they can fill the ponds at a higher rate, but again this is generally on a one-time basis when they are filling the ponds. The Production Well water right allows pumping up to 500 gpm.

In relation to the sediment sampling program, Knife River will sample within the Process Water Ponds depending on the availability of water versus sediment or slimes. Knife River plans to collect sediment samples from Pond 1(coarsest sediment) and Pond 4 (finest sediment).

The WW-Standing Water (**Figure 1**) sampling point can be the most difficult from which to obtain a valid water sample and may have questionable technical value. It has only been added to this sampling plan based on DOGAMI's request of October 25, 2024. This sampling point varies in available water and is greatly influenced by direct precipitation and stormwater. Generally, Knife

River protocol does not endorse sampling standing or stagnant water, but based on DOGAMI's request, Knife River is willing to collect a sample from this location.

2.2 Sample Parameters and Frequency

Knife River has surveyed all its completed monitoring wells, including "ground" and "top of casing" measurements, to assess changes in groundwater levels and flow directions during the monitoring period. "Top of casing" will serve as the reference point for all static water level measurements. Knife River proposes to install pressure transducers and measure water levels continuously (data recorded at a minimum of 12-hour intervals) in MW-1, MW-2, MW-3, MW4, and WW-2A, with data downloaded quarterly. For wells with continuous water level monitors, measurements will be manually checked and calibrated monthly for the first three months, then quarterly thereafter. Shallow aquifer monitoring wells without transducers will be manually measured and monitored monthly for a minimum of one year. Changes in the water level measuring schedule will require approval from DOGAMI and DEQ. Additionally, monthly water level measurements will be collected for all offsite shallow aquifer wells including offsite wells 4144, 3992, 3320, and the Vanier House Well for a similar one-year period. Water levels for the deep aquifer wells will be collected on a quarterly basis. **Table 3** presents Sampling Schedule and Frequency.

Static water level measurements will be taken from all monitoring wells (including those with transducers) identified on **Figure 1** at the time of sample collection. Synoptic gauging events (gathering depth to water level measurements at all wells) will be performed before purging and sampling, and wells will be allowed to equilibrate as needed before gauging. Following EPA protocols (EPA, 1991), equilibration is confirmed when water level fluctuations are less than 0.05 feet in three successive measurements after removing any well cap. Knife River will attempt to gather water levels on domestic or industrial water supply wells at opportune times, but it may not always be practical to obtain static water levels on these wells. Water elevation data will be collected quarterly at the "ditch/slough Water Intake" site and ponds.

Knife River will collect quarterly water quality samples from the wells and quarterly surface water samples to assess seasonal impacts, if any, on water quality from the sources identified in **Figure 1**. The groundwater and surface water data collection will consider hydrologic conditions such as: end of summer (i.e., low water condition); springtime (i.e., high water condition); during irrigation season; and after ditches are shut off. After one year, Knife River will petition DOGAMI and DEQ to either continue the current strategy or may petition to adjust monitoring frequency or parameters.

Knife River will collect field parameters during well purging and sampling for all field parameters, including pH, conductivity (EC), temperature, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Field parameters will also be measured prior to sampling from surface water sources (**Figure 1**) and will include pH, EC, temperature (°C), DO, ORP, and turbidity (NTU). All EPA sample handling and Chain of Custody protocols will be followed.

Knife River also commits that during one sampling round, they will assess whether the use of different well purging methods has any material effect on water quality results. Four monitor wells (MW-2, MW-5, MW-6, and MW-7) will be purged and sampled using both purge methods to compare analytical results and thereby determine if there is any significant difference in analytical results based on the purge method. The purging and sampling of these wells using the two different methods will be completed on two different days within the same quarterly sampling event. Should a significant difference be determined, Knife River will discuss the difference with

DEQ and DOGAMI and identify the most applicable and representative protocol for sampling all wells without dedicated pumping equipment during future sampling rounds.

Samples from the groundwater wells and surface water sources will be submitted to an EPA-certified laboratory for analysis. All metals will be analyzed for both total and dissolved species. Knife River intends to submit all water and soil samples to Neilson Research Corporation of Medford, Oregon, for testing. Table B1 in **Appendix B** presents a list of laboratories in Oregon that are certified by both the EPA and the Oregon DEQ. Lab certifications can also be found in **Appendix B**. The general analyte (**GA**) list that will be performed on all groundwater and surface water samples will include the following:

- Laboratory pH, EC, and Total Dissolved Solids (TDS)
- Total Organic Carbon (TOC)
- Dissolved and total manganese (Mn)
- Dissolved and total iron (Fe)
- Dissolved and total aluminum (Al)
- Dissolved and total Arsenic (As)
- Nitrates (NO3+NO2) as N
- Major Cations: calcium, magnesium, sodium, potassium
- Major Anions: sulfate (SO4), chloride (Cl), carbonate (CO3), and bicarbonate (HCO3)
- Coliform
- Turbidity (NTU)

Knife River will sample monitoring wells completed in the shallow aquifer for the following petroleum hydrocarbons (PH):

- Gasoline Range Organics (GRO)
- Diesel Range Organics (DRO)

Knife River plans to complete the analysis for these petroleum hydrocarbon (**PH**) constituents one time for all the shallow aquifer wells. After that sampling event, Knife River plans to sample MW-1, MW-2, MW-3, MW-4, and WW-2A quarterly for DRO and GRO to establish a Vanier Baseline for at least one year. If GRO or DRO is detected in any well during any sampling event, Knife River will conduct follow-up sampling for the appropriate parameter, within a month of receiving sample results. No sampling of the deep aquifer wells for these additional analytes is planned.

Finally, Knife River will collect a minimum of two soil samples from the sediment within the wash pond complex, one sediment sample at the Water Intake site and two soil samples upgradient from mining operations twice during the one-year sampling period as shown on **Figure 1**. These samples will be collected using a California Tube pushed into the sludge until refusal is encountered. Each sample will be capped and sealed and delivered to the laboratory. The two remaining samples will be collected from Woodward reclaim and Vanier native soils. These latter two samples (Sed 4 and Sed 5) will be collected at a depth of 12 to 15 inches and/or below the organic horizon. All samples will be placed in a Ziploc bag, labelled, and delivered to the laboratory. The soil samples will be analyzed for manganese, aluminum and iron using the following three methods:

- Total Metals (Mn, Al, Fe). Total Metals indicates as the name states total metals or whole element analysis. It is accomplished after “acidification” (use of a strong acid) of all of the sediment and an analysis of all metals present- whether mobile or immobile.

- Extractable Metals (AB-DPTA). Extractable metals indicates those metals which can be extracted by an organic solvent (AB-DPTA) and reflect the metal concentration that is likely to go into solution and are available for plant uptake or movement through the unsaturated or vadose zone.
- RCRA-based TCLP extraction. As the name suggests, this is the standard method used in the determination of hazardous waste-recognizing that neither Mn, Al, nor Fe are determined to be a hazardous waste or a hazardous chemical. In fact, there is no maximum contaminant level for Mn and EPA has only established an aesthetic standard and a Health Advisory Level. The TCLP extraction method uses acetic acid and sodium hydroxide as an extraction solvent.

In addition, all soil analyses will be analyzed for nitrate-nitrogen. This analysis will address the impacts of fertilizers on the soils and water courses that may influence shallow aquifer water chemistry.

2.3 Sample QA/QC

Knife River plans to collect one duplicate sample and one blank per sampling event. In addition, one rinseate or equipment blank sample will be collected during the monitoring period. As such, the duplicate may be obtained from either a surface water or groundwater source but will be collected to check on the laboratory results. The blank and rinseate samples will provide data regarding the field sampling methods.

2.4 Sample Collection Protocol

Knife River will continue to collect and document sample collection in accordance with EPA protocols and will deliver all samples to the respective laboratory within the required sample holding times. A list of approved Oregon laboratories is included in **Appendix B**. Knife River sampling protocol includes:

- **Equipment and Preparation:** Arrive on-site with laboratory-approved sample bottles, Chain of Custody forms, laboratory-provided preservatives, field filters (as applicable), ice, pumping equipment, and shipping coolers.
- **Site and Well Condition Documentation:** The sampler will document the condition of the well or sampling site (for surface water and soil), including any observations of vandalism, access issues, water use, or whether the well is pumping. Field notes will also record weather conditions, recent heavy rainfall, adjacent land irrigation, standing water on-site, and any recent site activities.
- **Water Level and Well Pumping Observation:** Measure the water level (depth to water for wells using a water level meter) and note if the domestic well is pumping. Wells will be allowed to equilibrate as needed before gauging. Equilibration is confirmed when water level fluctuations are less than 0.05 feet over three successive measurements.
- **Flow and Depth Estimates:** Estimate water flow (for surface water) or the depth for soil sampling. Collect photographs on site of all surface water and sediment locations.
- **Dedicated Tubing:** the sampler may use tubing that is dedicated to each respective well, assuming the tubing was new prior to sampling. This tubing will only be used to purge and sample the same well during each sampling event.

- **Well Purging Procedure (See Section 2.2) for the Assessment of Procedures:** The sampler will calculate the required purge volume using the measured depth to water and total well depth, ensuring the sample represents groundwater from the aquifer rather than the well casing. Based on **Table 3**, either a minimum of three casing volumes will be purged using a dedicated submersible pump already installed in a production or domestic water supply well, or low-flow purging principles will be used for wells that do not have dedicated pumping equipment installed. Both methodologies (three casing volume and low flow purge methods) are acceptable EPA protocols for collecting representative groundwater samples for metals (Mn, Fe, Al). In an effort to address EPA/DEQ review comments, Knife River will incorporate both the three casing volumes purging method with parameter stabilization and low flow purging techniques based on the well type and presence of existing pumping equipment.

  The purging method to be used for each respective well is identified on **Table 3**. For any well not equipped with dedicated pumping equipment, at least one casing volume will be purged with the pump set in the middle of the screen before sampling under the low flow purging method. Any production or domestic water supply well with dedicated pumping equipment will be purged and sampled using the existing pumping equipment with the pump intake set at its current depth. Under both purging approaches, water quality parameters will be monitored throughout the purging process to identify when water quality parameters have stabilized, and representative aquifer water is being discharged. The revised procedure acknowledges the importance of minimizing drawdown in monitoring wells (<0.3 feet, ideally) regardless of the pumping rate used for purging.

- **Field Parameters Measurement:** Using a handheld water quality meter, the sampler will measure field parameters, including pH, conductivity (EC), temperature (°C), and turbidity (NTU), dissolved oxygen (DO), and oxidation-reduction potential (ORP) at roughly 2-to-5-minute intervals throughout the purging period prior to sampling.

- **Field Parameter Stabilization:** If field parameters stabilize after three casing volumes or at least one volume depending upon the purging method used, the sampler will collect the sample, filter in the field as necessary, and/or preserve samples as required. If field parameters do not stabilize or if additional purging is deemed necessary, the sampler will continue purging the well until all field parameters stabilize and the well is yielding groundwater representative of the aquifer as determined by the sampler's professional judgment. According to EPA guidelines (EPA, 2015), parameters are considered stable when they show minimal variation (typically within ±10%) over 15 to 30 minutes, indicating the water is representative of the aquifer. Stabilization thresholds are:

  - Water level: 0.3 feet
  - pH: ±0.5 units
  - Conductivity: ±3% of previous reading
  - Temperature: ±0.2°C

- **Final Field Parameter Measurement:** Prior to completing sampling at each well, the sampler will measure a final depth to water while pumping and record the following final parameters: pH, conductivity (EC), temperature (°C), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity (NTU). All metals samples will be field filtered (0.45µm) and preserved so dissolved analysis can be completed.

    - Metals samples (both Total and Dissolved) will be preserved in the field, and the pH will be verified to ensure it is at or below 2.

- **Surface Water Sampling:** Surface water samples and in particular "pond water" samples (WWSP1 and WWSP3) will contain significant volumes of suspended solids. As such field filtration may be difficult. In an effort to meet the analytical requirements for both dissolved and total metals, the sample will either be field filtered (0.45µm) or the sampler will cool to 4°C and send to the laboratory in an unpreserved bottle. This will allow the accurate completion of a dissolved analysis in addition to total metals. For pond water samples, the sampler will analyze EC and pH in the field prior to filtration.

- **Soil Sampling Considerations:** For soil samples, the sampler will employ the following methods to ensure accurate and representative soil composition:

    - The sampler will target collecting soil from the mineral layer, avoiding surface layers that may contain excess organic matter. In areas where organic material is prevalent, sampling will focus on the deeper mineral horizon to ensure that the sample reflects the true soil composition. It is anticipated that soil samples will be collected at a depth of 12 to 15 inches.

- **Sample Labeling and Shipping:** All water samples will be labeled and placed in a shipping container or cooler with ice to maintain a temperature of 4°C.

- **Chain of Custody:** The sampler will fill out the Chain of Custody form, coordinate with the laboratory for sample receipt, and ensure the sample is shipped promptly to the laboratory to meet holding times.

- **Holding Times and Preservation:** Holding times are critical and vary depending on the parameter (e.g., coliform has a very short holding time). Based on EPA protocol, the holding time for most unpreserved metals is 48 hours.

- **Soil Sample Shipping:** Soil samples can be placed in plastic Ziploc bags, labeled and shipped to the laboratory for analysis. Chain of Custody forms will accompany soil samples.

- **Decontamination Procedures:** As necessary, decontamination of all multi-use equipment between wells will be performed using an Alconox and distilled water mixture to clean equipment and be rinsed with distilled water.

2.5 *Data Analysis Procedure*

In compliance with OAR 340-040-0030(2), this sampling plan includes a comprehensive Data Analysis Procedure to evaluate analytical data from groundwater, surface water, and soil/sediment samples. The analysis will use statistical methods such as comparative and trend analysis, data normalization, and spatial variability assessments to evaluate water quality against regulatory standards. Data will be analyzed quarterly to assess trends, detect potential impacts from site operations, and identify exceedances of water quality criteria. Special focus will be placed on seasonal variations, spatial patterns, and the migration of contaminants, particularly manganese.

Potential impacts on groundwater quality will be quantified by comparing manganese concentrations collected at upgradient background wells with those from wells downgradient of

facility operations. This interwell analysis will be conducted using a one-way analysis of variance (ANOVA) to determine if there are statistically significant differences in manganese concentrations (mg/L) between samples from background and potentially impacted wells ($\alpha = 0.05$). The one-way ANOVA approach was chosen for efficiency in retaining degrees of freedom compared to more complex methods, thereby providing greater statistical power to accurately quantify variance and ensure reliable results. Analyses and data visualizations will be conducted using the statistical program R (R Core Team 2024). The frequency of analysis will repeat quarterly to align with ongoing sample collection intervals.

Because a confining layer separates the shallow and deep aquifers, this analysis will focus on monitoring wells that draw groundwater from the uppermost (shallow) aquifer, which is more likely to be affected by site activities. For this analysis, shallow wells are defined as those less than 75 feet deep. The background wells include MW-1 and MW-2, as well as the Vanier House Well, which is located upgradient (Wenck 2021; water table map 2024). These wells are located approximately 1,500 feet northwest of the Woodward property line and about 3,000 feet upgradient from formerly active mining operations. The immediately downgradient shallow wells (MW-5, MW-6, and MW-7) are also situated on the Woodward Site. Another cluster of shallow wells exist outside the permit area and include CRO 953 (Elbek), CRO 939 (Porfily) and CRO 948 (McCormick). These three wells shall be analyzed in a third group. These wells were sampled by MFA one time and Knife River recommends that DEQ sample them quarterly in conjunction with Knife River's sampling program. If landowner consent could be obtained, Knife River could add these three wells into their sampling program.

Following data collection, Knife River will develop a Conceptual Site Model (CSM) to assess the spatial distribution and migration of contaminants, considering interactions between shallow and deep aquifers, and the influence of subsurface features like improperly abandoned wells or buried channels as appropriate. Findings from the data analysis will guide corrective actions or adjustments to the sampling program to maintain regulatory compliance, with reports reviewed by qualified personnel to determine necessary changes to monitoring protocols or remedial actions.

3.0 DATA EVALUATION AND REPORTING

Knife River will collect, validate, and manage groundwater, surface water, and soil data in a centralized database, ensuring quality control through EPA-compliant validation procedures. Statistical analyses, including trend and spatial variability assessments, will be used to evaluate changes in water chemistry over time. If concentrations exceed regulatory thresholds, further statistical evaluations will be conducted to identify sources and potential impacts, with findings informing updates to the CSM to refine the understanding of contaminant behavior and migration pathways. Knife River has made efforts and will continue to evaluate the high groundwater inflow rates that were observed in the shallow aquifer in 2021 at the east end of Woodward (Stantec, 2021). That information will be considered along with information about potential sources, such as an improperly abandoned deep aquifer well or a buried channel in the shallow aquifer.

Groundwater flow and contaminant transport will be assessed through monitoring well data, potentiometric surface maps, and flow modeling, considering factors such as hydraulic conductivity, groundwater flux, and redox conditions. Results will be compiled into annual reports (spring), including analytical results, statistical trends, appropriate statistical analysis, regulatory comparisons, and CSM updates. Any CSM will be complicated by the fact that no site-specific baseline water quality data were collected prior to mining and historic data suggests manganese "hot spots" are present in the general area of the mine and that these "hot spots" existed prior to

mining. Reports will be shared with DEQ, DOGAMI, and stakeholders, with recommendations for monitoring adjustments based on observed trends and regulatory feedback. The annual reporting will also identify data gaps and suggest means to address such data gaps.

4.0 SUMMARY

Knife River has developed a comprehensive sampling and monitoring plan for the Woodward and Vanier properties, which will involve groundwater and surface water sampling over a minimum one-year period. Groundwater monitoring will include shallow and deep aquifer wells, as well as offsite wells where neighbors have granted access for sampling. A total of 17 wells, both shallow and deep, will be sampled quarterly, and the water levels in these wells will be monitored manually monthly and at the time of sampling. Additionally, Knife River will install pressure transducers in five upgradient monitoring wells to continuously measure water levels. Surface water sampling will be conducted quarterly at key locations, including Knife River's processing ponds, Water Intake, and standing water areas, as identified by DOGAMI. A sediment sampling plan will also be included as part of this effort. The water and sediment samples will be analyzed for a variety of chemical constituents of public concern, including manganese, aluminum, and iron, as well as major anions, cations, nitrates, and coliforms. In compliance with Crook County land use conditions, groundwater samples from Vanier wells (MW-1, MW-2, MW-3, MW-4 and WW-2A) will also include testing for GRO and DRO. At EPA's request, Knife River will complete a one-time sampling of all shallow wells for GRO and DRO.

All sample data collection, handling, and delivery to an EPA-certified laboratory will follow strict EPA Sample Handling and Chain of Custody protocols. Quarterly groundwater sampling and quarterly surface water sampling will continue for at least one year, with all data being reported to regulatory agencies such as DOGAMI, DEQ, and Crook County. The data collected will be analyzed for trends and compared to regulatory standards. An annual report (spring) will summarize analytical results, trend analysis, and regulatory comparisons, and will include updates to the CSM. After one year, based on data analysis and regulatory feedback, Knife River may petition the regulatory agencies for adjustments to sampling frequency, analytical constituents, or sample locations. The full set of field and laboratory certifications will accompany the data reports, ensuring compliance with all relevant regulations.

5.0 REFERENCES

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Tables

Table 1. KRC Shallow Aquifer Monitoring Wells

CROO Number	Current Homeowner/ Well Name	Well Owner Name	Tax Lot	Address	Completed Depth	Completed Perf or Screen	Depth to First Water[1] (ft bgs)	Yield (gpm)	Completed Date	Aquifer Lithology	Interval (ft bgs)	Temperature (deg F)	Measuring Point Elevation NGVD 1929	Static Water Level October 2024
55482	MW1	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	13	5	3/4/2024	WB brown silty sand	17-36	53	2910.9	2906.4
55480	MW2	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	16	10	3/5/2024	WB light brown silty gravel	16-36	53	2923.0	2912.2
55481	MW3	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	35.5	16	17	10	3/8/2024	WB silty gravel; WB clayey silt	17-25; 25-35.5	53	2925.6	2910.1
55483	MW4	Knife River	1415140000103	4755 NW Stahancyk Ln. Prineville, OR 97754	36	16	26	10	3/11/2024	Brown silt and clay; clay gravels	20-26; 26-36	53	2927.9	2907.4
55570	MW5	Knife River	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	71	51	25	20	9/13/2024	Grey sand with silt	51-71	53	2901.9	2880.1
55571	MW6	Knife River	1415140000702	4755 Stahancyk Ln. Prineville, OR 97754	62	42	46	15	9/17/2024	Gravel; silt and sand	24-34; 46-62	53	2904.1	2869.9
55572	MW7	Knife River	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	54.5	34.5	30	10	9/17/2024	Fine sand	29-45	53	2908.1	2886.4
55017	WW-1A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	30	10	21	NR	1/18/2021	Sand, gravel, and cobbles	0-30	56	2928.0	2907.4
55018	WW-2A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	25	10	20	NR	1/18/2021	Sand, gravel, and cobbles	0-25	56	2927.4	2907.5
55019	WW-3A	Woodward Land & Timber LLC	1415140000703	4755 NW Stahancyk Ln. Prineville, OR 97754	28	13	20	NR	1/20/2021	Sand, gravel, and cobbles	10-28	56	2924.8	2908.3
977	3992/Mikulski	Elmer Self	1415230000111	3992 NW Stahancyk Ln. Prineville, OR 97754	50	30	NR	30	3/29/1969	Sand and gravel	28-50	56	2928.0	2902.1
NR	Vanier	NR	1415140000103	6487 NW Lamonta Rd. Prineville, OR 97754	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
970	3320/Johnson	Ray Fox	1415230000102	3320 NW Stahancyk Ln. Prineville, OR 97754	40	20	23	15	8/16/1982	Fine Sand	22-40	56	NR	NR

Notes:
1 – first occurrence of observable water during drilling and/or installation of the well.
ft bgs = feet below ground surface
gpm = gallons per minute
deg F = degrees Fahrenheit
WB = water bearing
NR = not reported

Table 2. KRC Deep Aquifer Monitoring Wells

CROO Number	Current Homeowner/Well Name	Well Owner Name	Tax Lot	Address	Completed Depth	Completed Perf or Screen	Depth to First Water	Yield (gpm)	Completed Date	Aquifer Lithology	Interval (ft bgs)	Temperature (deg F)	Measuring Point Elevation NGVD 1929	Static Water Level October 2024
55536/55470	Knife River	Knife River Production	1415140000703	4755 Stahancyk Ln. Prineville, OR 97754	291	257	7	291	6/24/2024	Fractured claystone	248-291	52	2906.6	2893.5
50140	Woodward	Prineville Sawmill Co.	1415140000702	4755 Stahancyk Ln. Prineville, OR 97754	255	250	60	300	7/15/1996	Gravel and sand	236-255	54	2913.4	2879.6
54339	3992-Deep/ Mikulski	Adam Mikulski	1415230000114	3992 NW Stahancyk Ln. Prineville, OR 97754	281	266	30	40	3/11/2016	Fine sand, gravel, and broken claystone	266-281	57	2928.0	2885.5
329	4144/Kriege	Ron Wilkinson	1415230000116	4144 NW Stahancyk Ln. Prineville, OR 97754	260	255	250	14	11/18/1991	Broken claystone	250-260	62	2919.6	2885.1

Table 3. Proposed Sampling Plan Schedule

Sampling Type	Location Name/Identifier	Purging and Sampling Method for Wells[4.]	Sampling Frequency[1]	Sample Parameters[2]	Notes[3]
Shallow Aquifer Wells (Upgradient)	MW-1, MW-2, MW-3, MW-4	Low flow	Quarterly, for a minimum of one year	GA & PH	Upgradient (east of Woodward mine-related disturbance)
	MW-7	Low flow	Quarterly, for a minimum of one year	GA & PH	Upgradient of processing ponds
	WW-2A	Low flow	Quarterly, for a minimum of one year	GA & PH	Will be sampled instead of WW-1A and WW-3A; Upgradient of Woodward Mine
	Vanier House Well	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Included before and after Vanier expansion
Shallow Aquifer Wells (Cross Gradient - Residential)	Mikulski (3992)	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Residential well
	Johnson (3320)	3 Well volumes	Quarterly, for a minimum of one year	GA & PH	Residential well
Shallow Aquifer Wells (Downgradient)	MW-5, MW-6	Low flow	Quarterly, for a minimum of one year	GA & PH	Downgradient of Process Water Ponds and mining operation
Deep Aquifer Wells	Knife River Production Well	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Woodward Shop Well	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Mikulski Deep Well (3992-Deep))	3 Well volumes	Quarterly, for a minimum of one year	GA	
	Kriege Deep Well (4144)	3 Well volumes	Quarterly, for a minimum of one year	GA	
Surface Water Sampling Sites	Knife River Processing Ponds	NA	Quarterly, for a minimum of one year	GA	Two locations: Pond 1 (initial processing) and Pond 3
	Knife River Water Intake (ditch/slough)	NA	Quarterly, for a minimum of one year	GA	Source of process/makeup water
	Standing Water (WW-Standing Water)	NA	Quarterly, for a minimum of one year	GA	Unreclaimed mine cell, sampling per DOGAMI request
Additional Sampling (Soil & Sediment)	Pond 1 & 4 Sediment Water Intake (SED1-SED3)	NA	Biannually	manganese, aluminum, nitrate as N, and iron	Collected per ODEQ request
	Upgradient Soil Samples (SED 4 and SED5)	NA	Biannually	manganese, aluminum, nitrate as N, and iron	Two locations, sampled twice per year

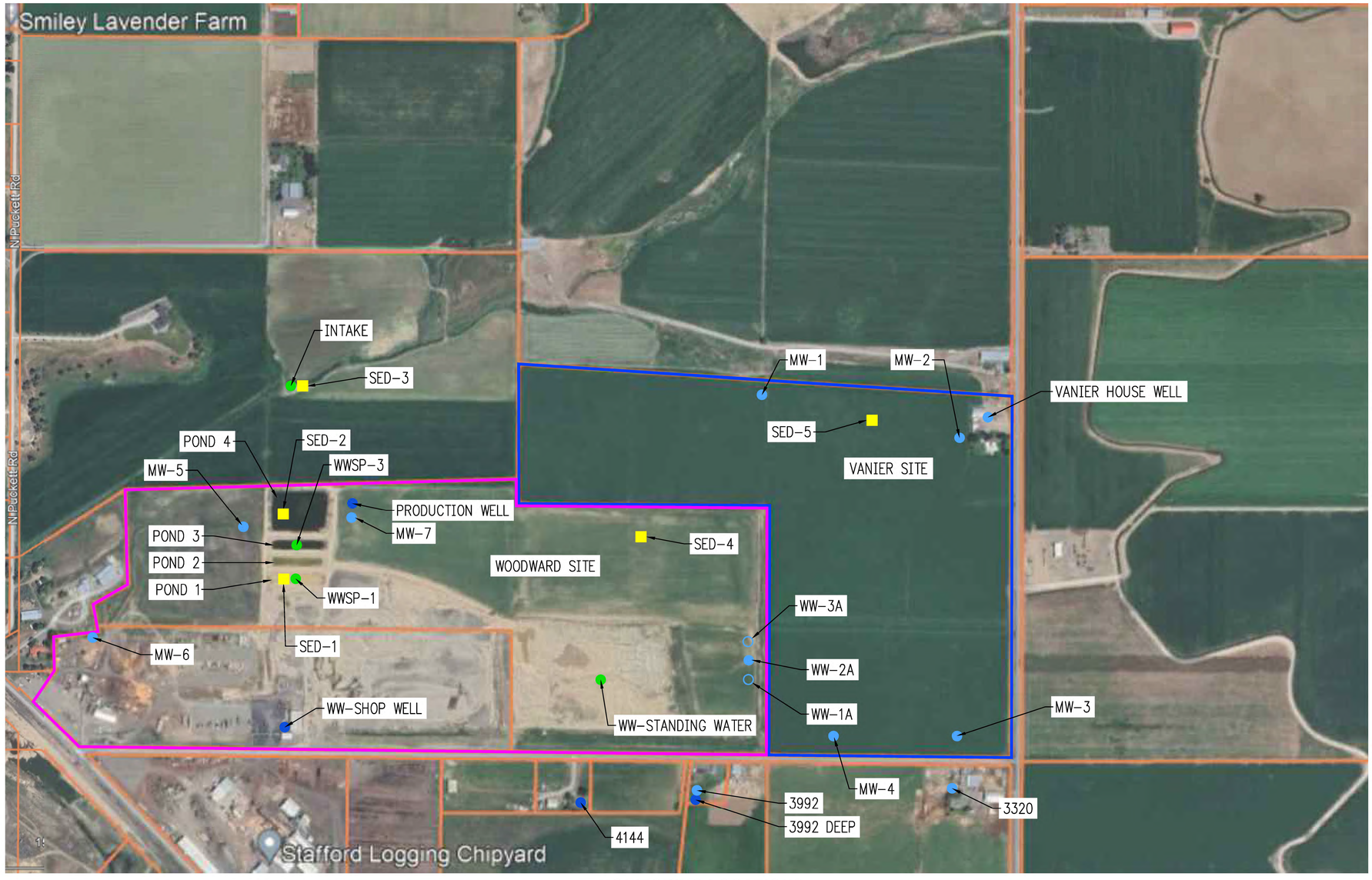
1 – Sampling frequency may be reduced with DOGAMI approval and DEQ consensus if the data demonstrate no operational or seasonal variation. Sampling will continue until DEQ and DOGAMI provide written notice to Knife River.
2 – Sample parameters listed in Section 2.2. GA refers to the general analytes listed in Section 2.2. These will be analyzed quarterly at all groundwater and surface water sites. PH refers to the GRO and DRO analytes that will be analyzed once at all shallow aquifer wells, and then quarterly at only MW-1, MW-2, MW-3, MW-4, and WW-2A for one year.
3- Sample locations generally shown on **Figure 1**.
4. Purging and sampling method will be established site specifically following evaluation as discussed. Knife River commits that during one sampling round, they will test the applicability of each procedure. Four monitor wells (MW-2, MW-5, MW-6, and MW-7) will be purged and sampled using both purge methods to compare analytical results and thereby determine if there is any significant difference in analytical results based on each respective method.

Figures

N

300' 0 150' 300' 600'

SCALE: 1" = 300'



NOTE: SEE TABLE 3 FOR FURTHER DETAILS REGARDING MONITORING LOCATIONS AND SAMPLING FREQUENCY

MONITORING LOCATIONS

SCALE: 1" = 300'

LEGEND

- – SHALLOW AQUIFER
- – DEEP AQUIFER
- – SURFACE WATER
- – ADDITIONAL MONITORING WELLS (NOT MONITORED OR SAMPLED AS PART OF THIS SAMPLING PLAN)
- – SEDIMENT SAMPLE LOCATIONS (SED)

VANIER EXPANSION
WOODWARD MINE
CROOK COUNTY
PRINEVILLE, OREGON 97754

KNIFE RIVER
MONITORING LOCATIONS

KNIFE RIVER

HUDSPETH LAND + WATER

FIGURE
01

FILE P:\0827-001 HLW Drafting Services - Various project\dwg\civil\Vanier Expansion\0827-027_VanierExp_Fig1, Layout: 02 SURFACE WATER AND SOIL SAMPLE LOCATIONS, Plot Date: 4/7/2025 3:42 PM, by: Cameron Johnson

Legend

- Shallow Water Wells
- Deep Water Wells
- Cross-Sections
- Permit Boundary

0 800 1,600 Feet

(At original document size of 11x17)
9,600

N

KNIFE RIVER

Project Location
T14S, R15E
Prineville, Crook Co., OR

Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024

Client/Project 227704752
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

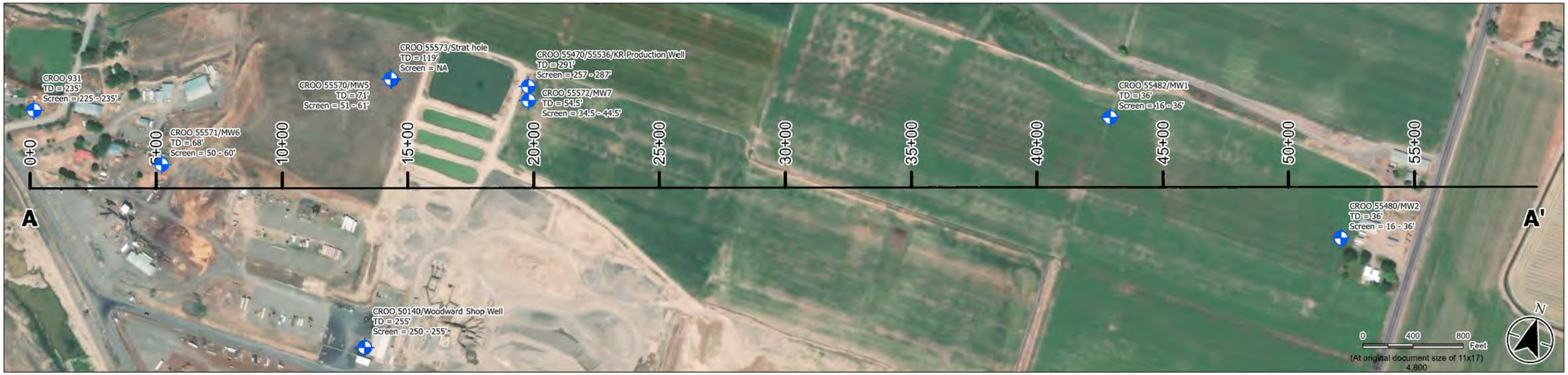
Figure No.
2

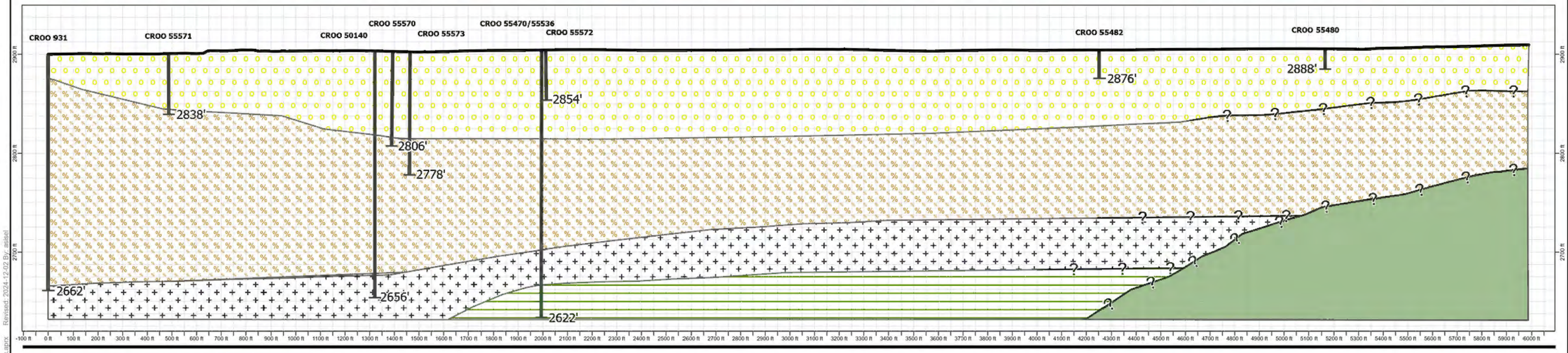
Title
Geologic Cross Section and Well Locations

Notes

1. Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
2. Data Sources: Stantec
3. Background: ESRI World Imagery 2023
4. Wells labeled by Oregon Water Resources Department well report number. TD (total depth in feet) and Screen (depth interval in feet) from well report

V:\2154\temporary\227704752_ArcPro\Prineville_OR_Xsec\Prineville_OR_Xsec.aprx Revised: 2024-12-02 By: aisbel





Notes

1. Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
2. Data Sources: Stantec
3. Background: ESRI World Imagery 2023
4. Wells labeled by Oregon Water Resources Department well report number. TD (total depth in feet) and Screen (depth interval in feet) from well report.
5. Cross-Section Profile is for viewing purposes only. Features are not set to an engineering scale
6. Lithology queried where uncertain

Legend

- Water Wells
- Cross-Section
- Drillhole
- Unknown Geological Contact
- John Day Formation
- Clay
- Claystone
- Gravel/Sand
- Sand

KNIFE RIVER

Project Location
T14S, R15E
Prineville, Crook Co., OR

Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024

Client/Project 227704752
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Figure No.
3

Title
Geologic Cross-Section A-A'

Revised: 2024-12-02 By: eisel
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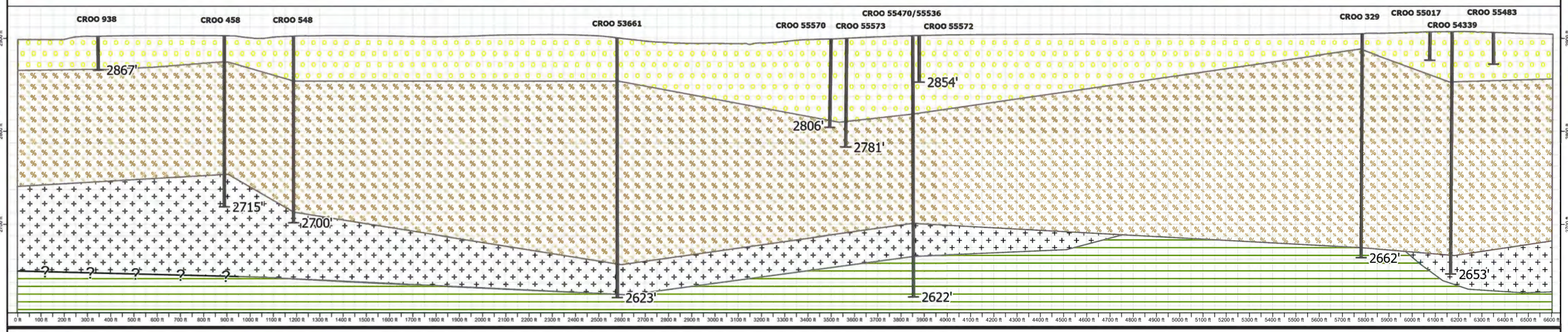

Legend

- Water Wells
- Cross-Section
- Drillhole
- Unknown Geological Contact
- Clay
- Claystone
- Gravel/Sand
- Sand

Notes

1. Coordinate System: NAD 1983 StatePlane Oregon South FIPS 3602 Feet
2. Data Sources: Stantec
3. Background: ESRI World Imagery 2023
4. Wells labeled by Oregon Water Resources Department well report number. TD (total depth in feet) and Screen (depth interval in feet) from well report.
5. Cross-Section Profile is for viewing purposes only. Features are not set to an engineering scale

KNIFE RIVER

Project Location
T14S, R15E
Prineville, Crook Co., OR

Prepared by KB on 12/2/2024
TR by EZ on 12/2/2024
IR by MS on 12/2/2024

Client/Project 227704752
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Figure No.
4

Title
Geologic Cross-Section B-B'

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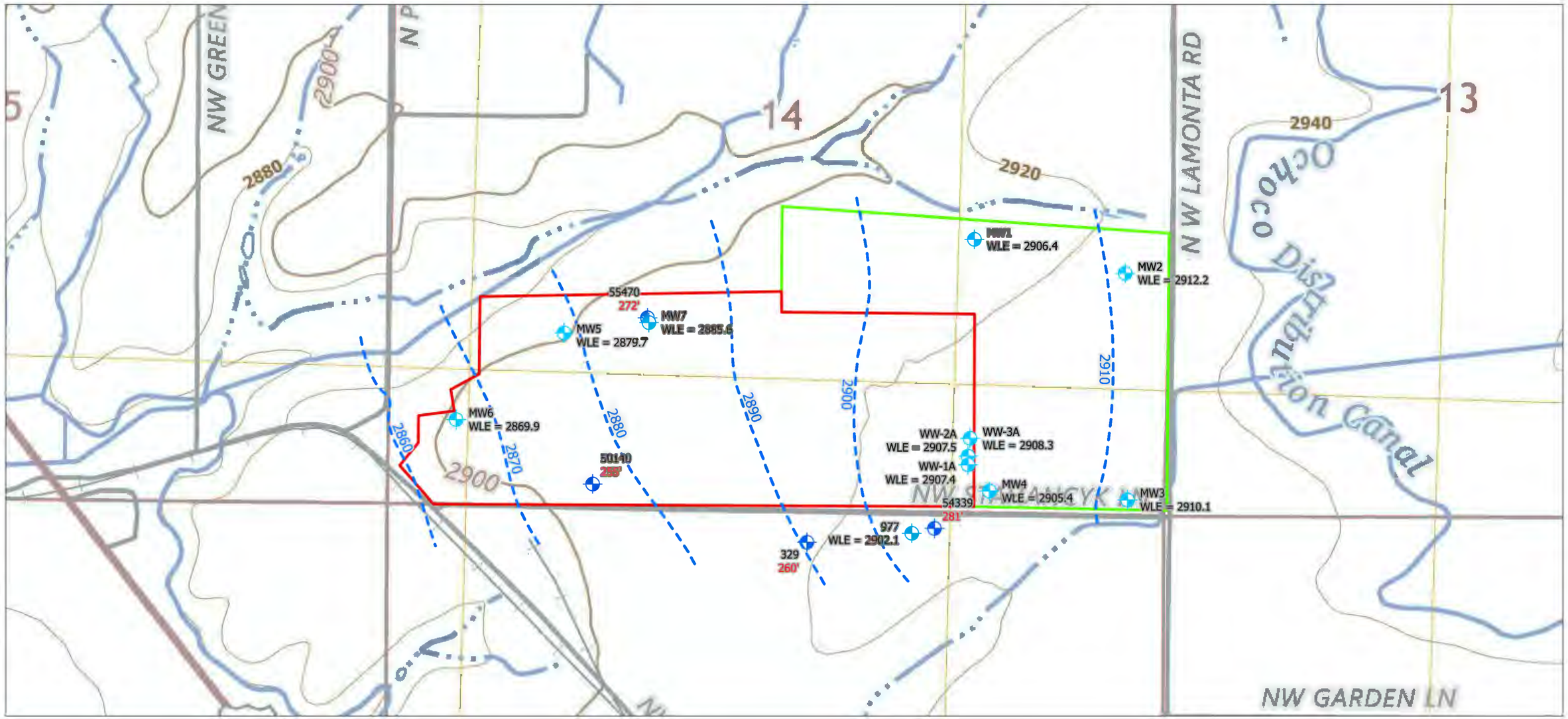
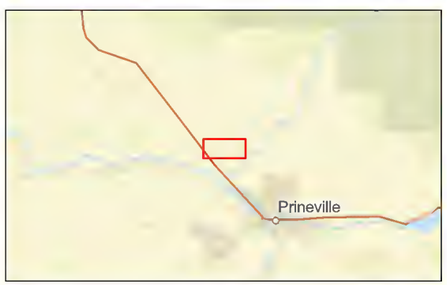




Legend

- Shallow Aquifer Water Wells
- Deep Aquifer Water Wells with Well Depth (Red)
- Groundwater Elevation Contours (Oct. 2024)
- Permit Boundary Woodward MLRR ID 07-0159
- Property Boundary Vanier

0 340 680 Feet
(At original document size of 11x17)
8,160

N

KNIFE RIVER

Project Location
T14S, R15E
Prineville, Crook Co., OR

Prepared by KB on 3/31/2025
TR by CB on 3/31/2025
IR by MS on 3/31/2025

Client/Project 227704752
Client: CDLidstone
Project: Woodward/Vanier Gravel Mine

Figure No.
5

Title
Shallow Aquifer Water Table Map

Notes
1. Coordinate System: NAD 1983 StataPlane Oregon South FIPS 3602 Feet
2. Data Sources: Stantac and USGS
3. Background: USGS 24k Topo Imagery 2023
4. Wells labeled by Knife River well name. WLE (water level elevation) based on depths to water measured on 10/17/24 and surveyed wellhead elevations.
5. Contour interval of the topographic map is 20 feet

Appendix A
Well Completion Reports

Amended 6/26/2025

CROO 55482

MW-1

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.545 & ORS 537.765 & OAR 690-240-0395)

4/25/2024

WELL I.D. LABEL# L 152274
START CARD # 1072891
ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D.

First Name BILL Last Name GIBSON
Company KNIFE RIVER
Address 32260 OLD HWY 34
City TANGENT State OR Zip 97389-9770

(2) TYPE OF WORK

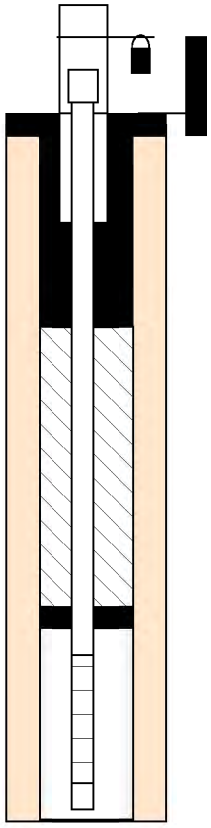
[X] New [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Hollow Stem Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) CONSTRUCTION

Piezometer Well [ ]
Depth of Completed Well 36.00 ft. Special Standard [ ]



MONUMENT/VAULT Above Ground
From 2 To 3

BORE HOLE
Diameter 12 From 0 To 3

CASING
Dia. 8 From [X] 2 To 3
Gauge .250 Wld Thrd
Material (•) Steel ( ) Plastic [X] [ ]

LINER
Dia. From [ ] To
Gauge Wld Thrd
Material ( ) Steel ( ) Plastic [ ] [ ]

SEAL
From 0 To 13
Material Bentonite Chips
Amount 5 Sacks Grout weight

SCREEN
Casing/Liner Casing Material PVC
Diameter 4 From 16 To 36
Slot Size 0.200

FILTER
From 13 To 36 Material SAND Size of pack 10/20
Seal Placement Begin Date 3/4/2024 Begin Time 15 15

(5) WELL TESTS

( ) Pump (•) Bailer ( ) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
5		36	1

Temperature 53 °F Lab analysis [ ] Yes By
Supervising Geologist/Engineer
Water quality concerns? [ ] Yes (describe below) TDS amount 150 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County CROOK Twp 14.00 S N/S Range 15.00 E E/W WM
Sec 14 NE 1/4 of the SE 1/4 Tax Lot 103
Tax Map Number Lot
Lat ° ' " or 44.35368000 DMS or DD
Long ° ' " or -120.89156000 DMS or DD
(•) Street address of well ( ) Nearest address
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	3/4/2024		[ ]	4

Flowing Artesian? [ ] Dry Hole? [ ]
WATER BEARING ZONES Depth water was first found 13.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
2/29/2024	13	36	26		[ ]	4
					[ ]	
					[ ]	
					[ ]	
					[ ]	

(8) WELL LOG

Ground Elevation 2912.23 FT

Material	From	To
CLAY GRAVELS SAND	0	3
WB LIGHT BROWN SILT SAND GRAVEL	3	17
WB SILT SAND BROWN	17	36

Construction Begin Date 2/29/2024 Begin Time 10 0 End Date 3/4/2024

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1720 Date 4/9/2024
Password : (if filing electronically)
Signed Jack Abbas

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 758 Date 4/25/2024
Password : (if filing electronically)
Signed THOMAS PECK (E-filed)
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

CROO 55482

4/25/2024

WELL I.D. LABEL# L 152274
START CARD # 1072891
ORIGINAL LOG #

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
9	3	51

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
●	○	4	☒	1.5	36	SCH 40	○	●	☐	☒

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Material	From	To

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name	Type	#
ZACHARY MIHEVC	TRAINEE WATER	8888935

Comments/Remarks

DRILLED TO 51'. BACKFILL TO 39' WITH PEA GRAVEL. BENTONITE FROM 39'-36'

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55482

4/25/2024

Map of Hole

STATE OF OREGON
WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department
725 Summer St NE, Salem OR 97301
(503)986-0900

LOCATION OF WELL

Latitude: 44.35368000 Datum: WGS84
Longitude: -120.89156000
Township/Range/Section/Quarter-Quarter Section:
WM14.00S15.00E14NESE
Address of Well:
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: 152274

Printed: April 9, 2024

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor

Amended 5/28/2024

CROO 55480

MW-2

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.545 & ORS 537.765 & OAR 690-240-0395)

4/25/2024

WELL I.D. LABEL# L 149468
START CARD # 1072892
ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D. 2

First Name BILL Last Name GIBSON
Company KNIFE RIVER
Address 32260 OLD HWY 34
City TANGENT State OR Zip 97389-9770

(2) TYPE OF WORK

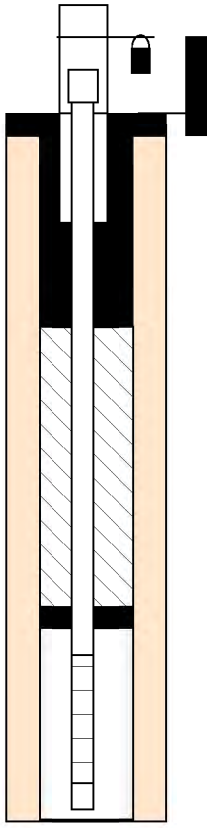
[X] New [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Hollow Stem Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) CONSTRUCTION

Piezometer Well [ ]
Depth of Completed Well 36.00 ft. Special Standard [ ]



MONUMENT/VAULT Above Ground
From 2 To 3

BORE HOLE
Diameter 12 From 0 To 3

CASING
Dia. 8 From [X] 2 To 3
Gauge .250 Wld Thrd
Material (•) Steel ( ) Plastic [X] [ ]

LINER
Dia. From [ ] To
Gauge Wld Thrd
Material ( ) Steel ( ) Plastic [ ] [ ]

SEAL
From 0 To 13
Material Bentonite Chips
Amount 6 Sacks Grout weight

SCREEN
Casing/Liner Casing Material PVC
Diameter 4 From 16 To 36
Slot Size 0.200

FILTER
From 13 To 36 Material SAND Size of pack 10/20
Seal Placement Begin Date 3/4/2024 Begin Time 15 30

(5) WELL TESTS

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
10		36	1

Temperature 53 °F Lab analysis [ ] Yes By
Supervising Geologist/Engineer
Water quality concerns? [ ] Yes (describe below) TDS amount 166 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County CROOK Twp 14.00 S N/S Range 15.00 E E/W WM
Sec 14 NE 1/4 of the SE 1/4 Tax Lot 103
Tax Map Number Lot
Lat ° ' " or 44.35316830 DMS or DD
Long ° ' " or -120.88766833 DMS or DD
(•) Street address of well ( ) Nearest address
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	3/5/2024		[ ]	12

Flowing Artesian? [ ] Dry Hole? [ ]
WATER BEARING ZONES
Depth water was first found 16.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
3/5/2024	16	36	10		[ ]	12
					[ ]	
					[ ]	
					[ ]	
					[ ]	

(8) WELL LOG

Ground Elevation 2924.66 FT

Material	From	To
CLAY GRAVELS SAND	0	16
WB LIGHT BROWN SILT GRAVELS	16	36

Construction Begin Date 3/4/2024 Begin Time 12 0 End Date 3/5/2024

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1720 Date 4/25/2024
Password : (if filing electronically)
Signed JACK ABBAS

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 758 Date 4/9/2024
Password : (if filing electronically)
Signed THOMAS PECK (E-filed)
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

CROO 55480

4/25/2024

WELL I.D. LABEL# L 149468
START CARD # 1072892
ORIGINAL LOG #

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
8	3	36

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
●	○	4	☒	1.5	16	SCH 40	○	●	☐	☒

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Material	From	To

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name	Type	#
ZACHARY MIHEVC	TRAINEE WATER	8888935

Comments/Remarks

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55480

4/25/2024

Map of Hole

STATE OF OREGON
WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department
725 Summer St NE, Salem OR 97301
(503)986-0900

LOCATION OF WELL

Latitude: 44.35316830 Datum: WGS84
Longitude: -120.88766833
Township/Range/Section/Quarter-Quarter Section:
WM14.00S15.00E14NESE
Address of Well:
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: 149468

Printed: April 9, 2024

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor

Amended 5/28/2024

CROO 55481

MW-3

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.545 & ORS 537.765 & OAR 690-240-0395)

4/25/2024

WELL I.D. LABEL# L 149464
START CARD # 1072893
ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D.

First Name BILL Last Name GIBSON
Company KNIFE RIVER
Address 32260 OLD HWY 34
City TANGENT State OR Zip 97389-9770

(2) TYPE OF WORK

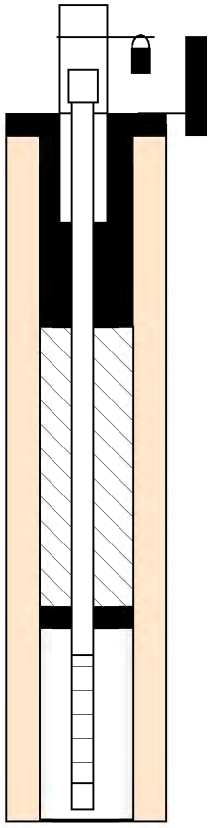
[X] New [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Hollow Stem Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) CONSTRUCTION

Piezometer Well [ ]
Depth of Completed Well 35.50 ft. Special Standard [ ]



MONUMENT/VAULT Above Ground
From 2 To 3

BORE HOLE
Diameter 12 From 0 To 2

CASING
Dia. 8 From [X] 2 To 3
Gauge .250 Wld Thrd
Material (•) Steel ( ) Plastic [X] [ ]

LINER
Dia. From [ ] To
Gauge Wld Thrd
Material ( ) Steel ( ) Plastic [ ] [ ]

SEAL
From 0 To 13.5
Material Bentonite Chips
Amount 5 Sacks Grout weight

SCREEN
Casing/Liner Casing Material PVC
Diameter 4 From 16 To 35.5
Slot Size 0.200

FILTER
From 13.5 To 35.5 Material SAND Size of pack 10/20
Seal Placement Begin Date 3/8/2024 Begin Time 14 30

(5) WELL TESTS

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
10		36	1

Temperature 53 °F Lab analysis [ ] Yes By
Supervising Geologist/Engineer
Water quality concerns? [ ] Yes (describe below) TDS amount 160 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County CROOK Twp 14.00 S N/S Range 15.00 E E/W WM
Sec 14 SE 1/4 of the SE 1/4 Tax Lot 102
Tax Map Number Lot
Lat ° ' " or 44.348633 DMS or DD
Long ° ' " or -120.887842 DMS or DD
(•) Street address of well ( ) Nearest address
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+ SWL(ft)
Existing Well / Predeepening			
Completed Well	3/8/2024		17

Flowing Artesian? [ ] Dry Hole? [ ]
WATER BEARING ZONES Depth water was first found 17.00

SWL Date	From	To	Est Flow	SWL(psi)	+ SWL(ft)
3/7/2024	17	35.5	10		17

(8) WELL LOG

Ground Elevation 2926.52 FT

Material	From	To
CLAY GRAVELS SMALL MED BROWN	0	17
WB SILT GRAVELS	17	25
WB CLAY SILT	25	35.5

Construction Begin Date 3/8/2024 Begin Time 11 0 End Date 3/8/2024

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1720 Date 4/25/2024
Password : (if filing electronically)
Signed JACK ABBAS (E-filed)

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 758 Date 4/9/2024
Password : (if filing electronically)
Signed THOMAS PECK(E-filed)
Contact Info (optional) JACK ABBAS

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

CROO 55481

4/25/2024

WELL I.D. LABEL# L 149464
START CARD # 1072893
ORIGINAL LOG #

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
9	2	35.5

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
●	○	4	☒	1.5	16	SCH 40	○	●	☐	☒
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
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○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	
					☐	

(8) WELL LOG

Material	From	To

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name	Type	#
ZACHARY MIHEVC	TRAINEE WATER	8888935

Comments/Remarks

STATE OF OREGON
WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department
725 Summer St NE, Salem OR 97301
(503)986-0900

LOCATION OF WELL

Latitude: 44.34863300 Datum: WGS84

Longitude: -120.887842

Township/Range/Section/Quarter-Quarter Section:

WM 14S 15E 14 SESE

Address of Well:

4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: L149464

Well Log: CROO 55481

Printed: May 28, 2024

DISCLAIMER: This map is intended to represent the approximate location of the exempt use well provided by the land owner. It is not intended to be construed as survey accurate in any manner.

Generated by OWRD

Amended 5/28/2024

CROO 55483

MW-4

STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.545 & ORS 537.765 & OAR 690-240-0395)

4/25/2024

WELL I.D. LABEL# L 149463
START CARD # 1072894
ORIGINAL LOG #

(1) LAND OWNER

Owner Well I.D.
First Name BILL Last Name GIBSON
Company KNIFE RIVER
Address 32260 OLD HWY 34
City TANGENT State OR Zip 97389-9770

(2) TYPE OF WORK

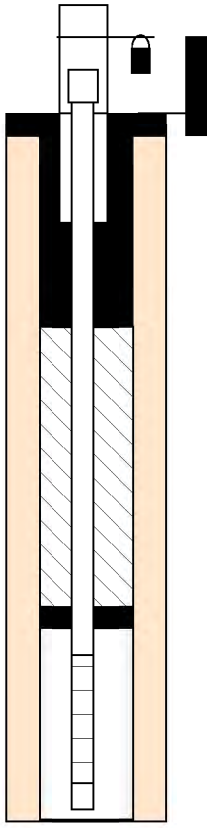
[X] New [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Hollow Stem Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) CONSTRUCTION

Piezometer Well [ ]
Depth of Completed Well 36.00 ft. Special Standard [ ]



MONUMENT/VAULT Above Ground
From 2 To 3

BORE HOLE
Diameter 12 From 0 To 3

CASING
Dia. 8 From [X] 2 To 3
Gauge .250 Wld Thrd
Material (•) Steel ( ) Plastic [X] [ ]

LINER
Dia. From [ ] To
Gauge Wld Thrd
Material ( ) Steel ( ) Plastic [ ] [ ]

SEAL
From 0 To 13
Material Bentonite Chips
Amount 4 Sacks Grout weight

SCREEN
Casing/Liner Casing Material PVC
Diameter 4 From 16 To 36
Slot Size 0.200

FILTER
From 13 To 36 Material SAND Size of pack 10/20
Seal Placement Begin Date 3/11/2024 Begin Time 11 40

(5) WELL TESTS

( ) Pump ( ) Bailer (•) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
10		36	1

Temperature 53 °F Lab analysis [ ] Yes By
Supervising Geologist/Engineer
Water quality concerns? [ ] Yes (describe below) TDS amount 172 ppm

From	To	Description	Amount	Units

(6) LOCATION OF WELL (legal description)

County CROOK Twp 14.00 S N/S Range 15.00 E E/W WM
Sec 14 SE 1/4 of the SE 1/4 Tax Lot 103
Tax Map Number Lot
Lat ° ' " or 44.34871830 DMS or DD
Long ° ' " or -120.89129000 DMS or DD
(•) Street address of well ( ) Nearest address
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

(7) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	3/11/2024		[ ]	25

Flowing Artesian? [ ] Dry Hole? [ ]
WATER BEARING ZONES Depth water was first found 26.00

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
3/11/2024	26	36	10		[ ]	25
					[ ]	
					[ ]	
					[ ]	
					[ ]	

(8) WELL LOG

Ground Elevation 2930.06 FT

Material	From	To
SILT CLAY BROWN	0	20
CLAY GRAVELS	20	26
WB CLAY SAND	26	36

Construction Begin Date 3/11/2024 Begin Time 9 0 End Date 3/11/2024

(unbonded) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1720 Date 4/25/2024
Password : (if filing electronically)
Signed JACK ABBAS (E-filed)

(bonded) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon monitoring well construction standards. This report is true to the best of my knowledge and belief.

License Number 758 Date 4/9/2024
Password : (if filing electronically)
Signed THOMAS PECK (E-filed)
Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT
THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version:

MONITORING WELL REPORT - continuation page

CROO 55483

4/25/2024

WELL I.D. LABEL# L 149463
START CARD # 1072894
ORIGINAL LOG #

(4) CONSTRUCTION

BORE HOLE

Dia	From	To
9	3	46

FILTER PACK

From	To	Material	Size

SEAL

Material	From	To	Amt	sacks/ lbs	grout weight

CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
●		4	☒	1.5	16	SCH 40		●		☒

SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn size/ slot width	Slot length	# of slots	Tele/ pipe size

(5) WELL TESTS

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(7) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(8) WELL LOG

Material	From	To

Name of person(s) who assisted with construction and Trainee License # / Helper #

Assistant Name	Type	#
ZACHARY MIHEVC	TRAINEE WATER	8888935

Comments/Remarks

BACK FILLED PEA GRAVEL 46' - 39'. BENTONITE CHIPS 39'-36'

MONITORING WELL REPORT - Map with location identified must be attached and shall include an approximate scale and north arrow

CROO 55483

4/25/2024

Map of Hole

STATE OF OREGON
WELL LOCATION MAP

This map is supplemental to the WATER SUPPLY WELL REPORT

Oregon Water Resources Department
725 Summer St NE, Salem OR 97301
(503)986-0900

OREGON WATER RESOURCES DEPARTMENT

LOCATION OF WELL

Latitude: 44.34871830 Datum: WGS84
Longitude: -120.89129000
Township/Range/Section/Quarter-Quarter Section:
WM14.00S15.00E14SESE
Address of Well:
4755 NW STAHANCYK LN PRINEVILLE, OR 97754

Well Label: 149463

Printed: April 9, 2024

DISCLAIMER: This map is intended to represent the approximate location the well. It is not intended to be construed as survey accurate in any manner.

Provided by well constructor

CROO 55570

KNIFE RIVER

PROJECT NAME: Woodward **Hole Number:** MW-5 **LOGGED BY:** B. Houston **Page:** 1:2

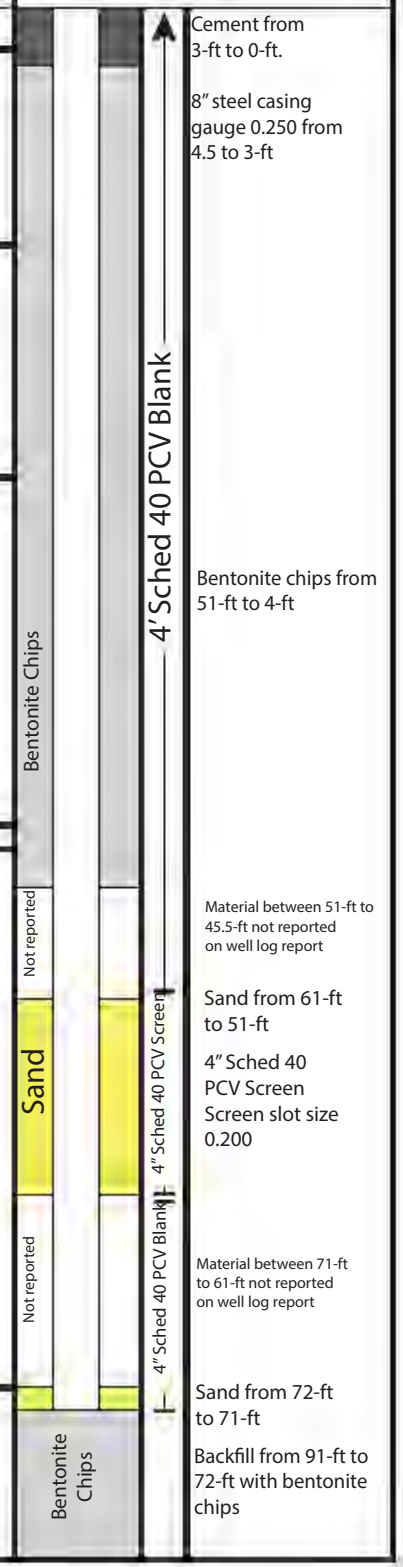
DATE STARTED: 09/10/2024 **COMPLETED:** 09/10/2024 **GROUND ELEVATION:** ~2,893-ft msl

DRILLING CONTRACTOR: Abbas Well Drilling **METHOD:** Air Rotary

FIRST WATER: **STATIC LEVEL:** **Flow RATE (gpm):**

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION
			Topsoil: Very fine sand and organic matter, brown
10			Sand with gravel (s: 60-70%; gr: 30-40%) Water Well Log: CROO 55570
20			Very fine sand, brown
			Cemented sand layer (1-2 cm) at 24-ft bgs Reddish to black cement possible FeO and MnO
30			H_2O at 25-ft bgs; Minor volume est. <5 gal./min. Very fine sand, brown
40			Silt, light tan
50			Very fine sand, brown, minor woody debris in returns H_2O at 51-ft bgs; Significant volume est. >50 gal./min.
60			
70			Blackish-tan, silt, contains sparse freshwater bivalves and minor woody debris in returns

Completion as report on CROO 55571



Cement from 3-ft to 0-ft.

8" steel casing gauge 0.250 from 4.5 to 3-ft

Bentonite chips from 51-ft to 4-ft

Material between 51-ft to 45.5-ft not reported on well log report

Sand from 61-ft to 51-ft

4" Sched 40 PCV Screen Screen slot size 0.200

Material between 71-ft to 61-ft not reported on well log report

Sand from 72-ft to 71-ft

Backfill from 91-ft to 72-ft with bentonite chips

PROJECT NAME: Woodward **Hole Number:** MW-5 **LOGGED BY:** B. Houston **Page:** 2:2

DATE STARTED: 09/10/2024 **COMPLETED:** 09/10/2024 **GROUND ELEVATION:**

DRILLING CONTRACTOR: Abbas Well Drilling **METHOD:** Air Rotary

FIRST WATER: 25-ft bgs **STATIC LEVEL: 23-ft bgs** **Flow RATE (gpm):**

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	Completion as report on CROO 55570
90			Blackish-tan, silt, contains sparse freshwater bivalves and minor woody debris in returns	Backfill from 91-ft to 72-ft with bentonite chips
			Clay, sticky dark gray, easily forms balls and rods	
			TD: 92-ft bgs	
				Annulus fill material not reported on the water well report from 61-ft to 71-ft

CROO 55571

KNIFE RIVER

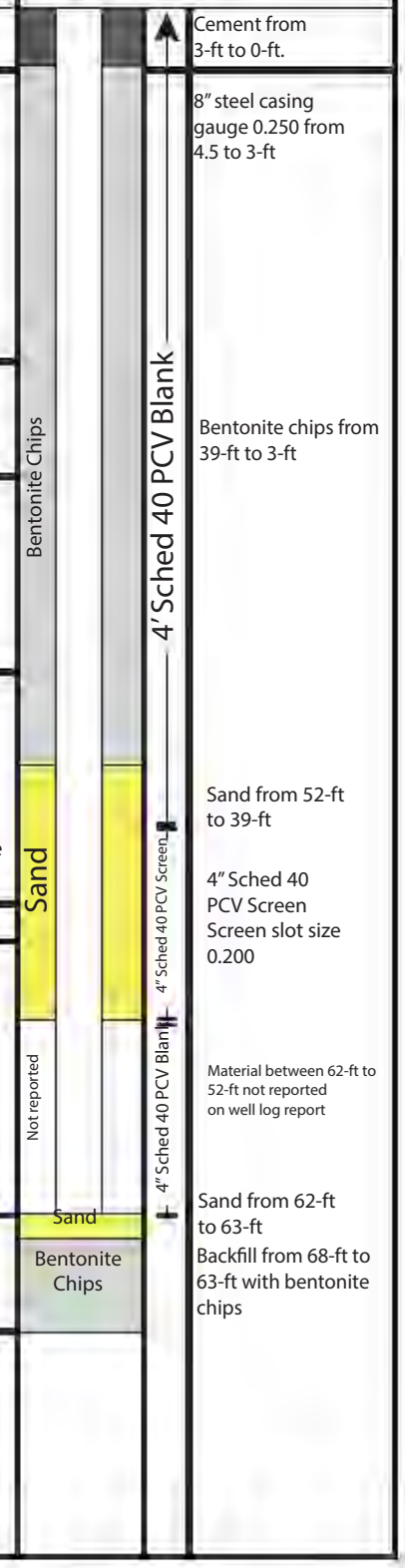
PROJECT NAME: Woodward **Hole Number:** MW-6 **LOGGED BY:** B. Houston **Page:** 1:1

DATE STARTED: 09/10/2024 **COMPLETED:** 09/10/2024 **GROUND ELEVATION:** ~2,902-ft msl

DRILLING CONTRACTOR: Abbas Well Drilling **METHOD:** Air Rotary

FIRST WATER: 46-ft bgs **STATIC LEVEL:** 34-ft bgs **Flow RATE (gpm):**

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION
			Topsoil: Very fine sand and organic matter, brown
10			Sand with gravel (s: 60-70%; gr: 30-40%)
20			
30			Gravel with minor sand (gr: 070-90%; s: 10-30%)
40			Clayey silt
			H_2O at 46-ft bgs; Significant volume est. >25 gal./min.
			Silty very fine sand, tan to brown
50			Very fine sand, brown
60			Clay, sticky dark gray, easily forms balls and rods
			TD: 68-ft bgs
70			



CROO 55572

PROJECT NAME: Woodward **Hole Number:** MW-7 **LOGGED BY:** B. Houston **Page:** 1:1

DATE STARTED: 09/18/2024 **COMPLETED:** **GROUND ELEVATION:** ~2,911-ft msl

DRILLING CONTRACTOR: Abbas Well Drilling **METHOD:** Air Rotary

FIRST WATER: 30-ft bgs **STATIC LEVEL:** 20-ft bgs **Flow RATE (gpm):**

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION
0			Topsoil: Very fine sand and organic matter, brown
10			Silty very fine sand, tan to brown
20			
30			H_2O at 30-ft bgs; Significant volume est. >25 gal./min.
40			Very fine sand, brown
50			Clayey silt
			Clay
60			Very fine sand, brown
			TD: 60-ft bgs
70			

Completion as report on CROO 55572

Cement from 3-ft to 0-ft.

8" steel casing gauge 0.250 from 4.5 to 3-ft

Bentonite chips from 31.5-ft to 3-ft

4" Sched 40 PCV Screen Screen slot size 0.200

As reported on the well log report Sand from 55-ft to 31.5-ft

As reported on the well log report there is either sand or bentonite chips from 55-ft to 45-ft

As reported on the well log report bentonite chips from 60-ft to 45-ft

PROJECT NAME: Woodward **Hole Number:** Strat Hole **LOGGED BY:** B. Houston **Page:** 1:2

DATE STARTED: 09/10/2024 **COMPLETED:** 09/10/2024 **GROUND ELEVATION:** ~2,893-ft msl

DRILLING CONTRACTOR: **METHOD:** DR-24HD - Dual Air Rotary

FIRST WATER: 18-ft bgs **STATIC LEVEL:** **Flow RATE (gpm):**

Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	SAMPLE INTERVAL	RECOVERY %	NOTES/REMARKS
			Topsoil: Very fine sand and organic matter, brown			
10			Very fine sand, brown			
			Sand with gravel (s: 60-70%; gr: 30-40%)			
20			Very fine sand, brown			H_2O at 18-ft bgs; Minor volume est. <5 gal./min.
30						
40						
50						
			Very fine sand, black (high % of magnetite)	2 to 66-ft		
60						
			Gray, clayey silt, contains minor woody debris in returns	69 to 105-ft		
70						
			Gravel with minor silt & clay			

PROJECT NAME: Woodward **Hole Number:** Strat Hole **LOGGED BY:** B. Houston **Page:** 2:2

DATE STARTED: 09/10/2024 **COMPLETED:** 09/10/2024 **GROUND ELEVATION:** ~2,893-ft msl

DRILLING CONTRACTOR: **METHOD:** DR-24HD - Dual Air Rotary

FIRST WATER: 18-ft bgs **STATIC LEVEL:** **Flow RATE (gpm):**

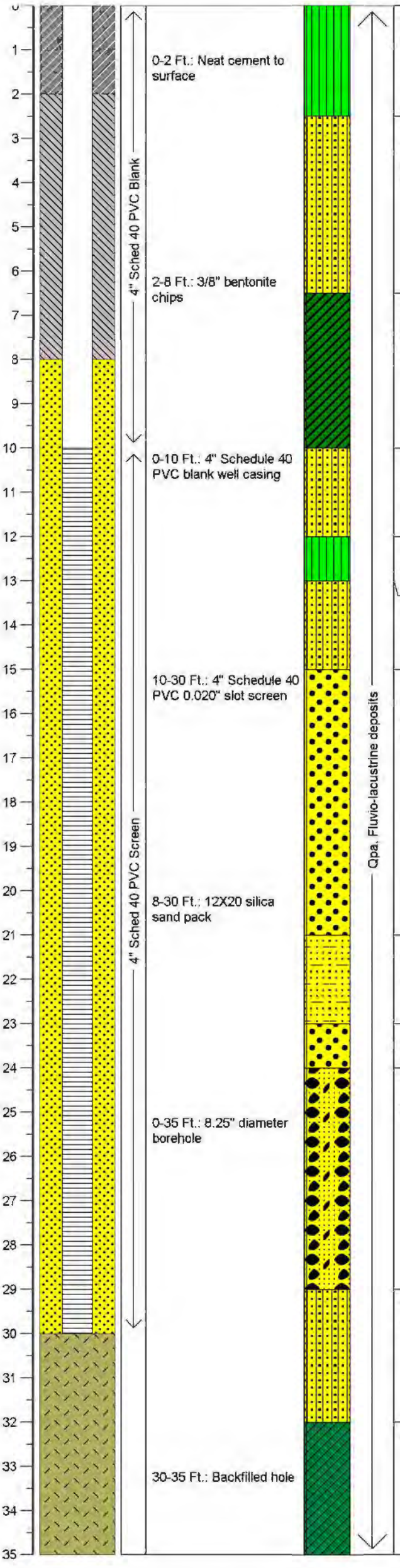
Depth (ft)	Elevation (ft)	GRAPHIC LOG	DESCRIPTION	SAMPLE INTERVAL	RECOVERY %	NOTES/REMARKS
			Gravel with minor silt & clay			
90			Clay, gray, easily forms balls and rods			
100						
110						
120						
130						

WENCK

now part of

Stantec

Project:	Woodward	Well Name:	WW-1A
Location:	44.34941°, -120.89169°	Drilling Method:	Sonic
Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
Date started:	1/18/2021	Total depth:	35 Ft.
Date completed:	1/18/2021	Elevation:	2928 Ft.



Well Construction	Lithology	Remarks
	0-3 Ft.: **SILT W/ SAND (ML)**: dark brown, rooted and moist with some organic content to 1.5', dries out below, fine sand well graded sand, low plasticity, somewhat cohesive, carbonate concretions at 3', silt is very carbonaceous, trace amounts of gravel at 4'	
	3-7 Ft.: **SILTY SAND (SM):** brown, medium to low plasticity, dry, fine sand in a carbonaceous silt, massive, carbonaceous concretions, sand is well sorted, poorly graded, platy structure and consolidated at 5', slightly to very carbonaceous, 0.25-0.5" bedding	
	7-10 Ft.: **FAT CLAY (CH):** brown, high plasticity, little to no coarse sediments, platy, medium to dense, cohesive, thinly bedded, non to slightly carbonaceous, 12" layer of medium grained poorly sorted sand at 8.5', some trace gravel, subrounded, back to clay at 9.5'	
	10-12 Ft.: **SILTY SAND (SM):** loose, moist, fine to medium grained sand, non plastic, noncohesive, blocky and semiconsolidated to 11', granular and unconcolidated below that, trace gravel ~1 cm in diameter	Water level measured at 20.73 feet bgs on 1/19/2021.
	12-13 Ft.: **SILT W/ SAND (ML):** brown, fine sand in a calcareous silt, loose, low to medium plasticity, cohesive, granular, brittle carbonaceous concretions, very carbonaceous	
	13-15 Ft.: **SILTY SAND (SM)**: noncalcareous, similar to 10-12' interval, moist, silt content decreases below 14', medium sorted, medium grained, sub rounded, noncalcareous, trace amounts of gravel ~1cm diameter	
	15-21 Ft.: **WELL GRADED SAND W/ SAND (SW):** brown, loose to medium dense, moist, nonplastic, noncohesive, granular, gravel between 0.5-1.5" in diameter, subrounded, 20-30%, gravel content decreases below 18', silty sand dominates below 19', noncalcareous	
	21-23 Ft.: **WELL GRADED SAND W/ SILT & GRAVEL (SW-SM):** loose, dry, fine sand in a calcareous silt, low plasticity, granular, gravel conetent 15-20%, 0.5-2" diameter	
	23-24 Ft.: **WELL GRADED SAND W/ GRAVEL (SW):** loose, moist, medium grained sand, nonplastic, noncohesive, granular	
	24-29 Ft.: **WELL GRADED GRAVEL W/ SAND (GW):** some silt and medium grained sand, gravel between 0.5-3" in diameter, well rounded, wet, sand and silt below 27', mostly gravel, sharp contact with clay layer below	
	29-32 Ft.: **SILTY SAND (SM):** wet, fine sand in a noncalcareous silt, gravel is gone, low to medium plasticity, massive, silt sontent increases significantly below 30', blocky, sand gone below 32'	
	32-35 Ft.: **LEAN CLAY (CL):** wet, medium plasticity, little to no coarse sediments	

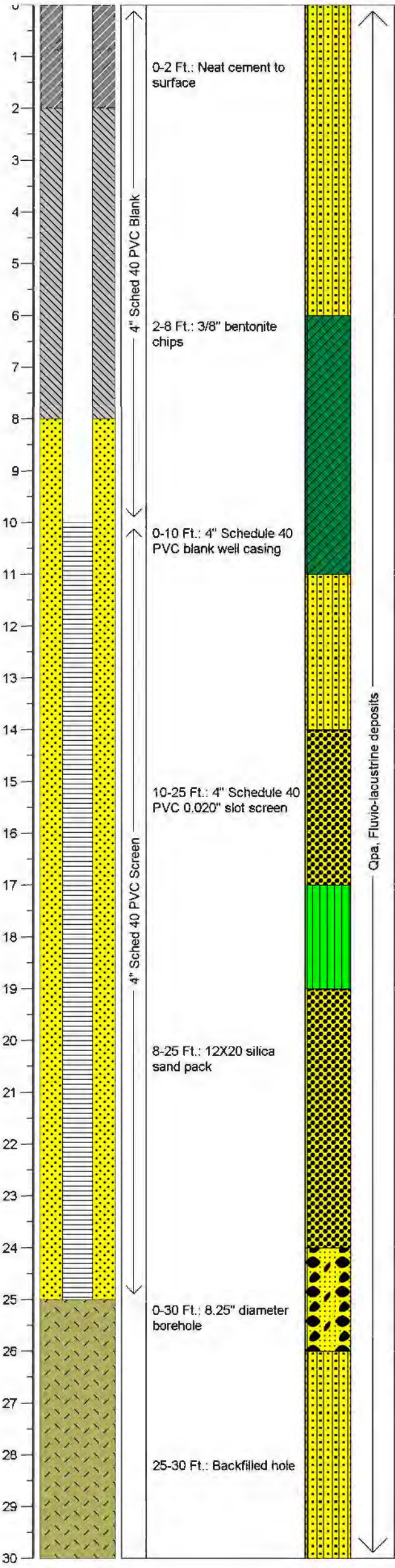
Notes: This figure presents the as-built details for WW-1A located near Knife River's ISR Woodward Property in the SESW of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for three hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.63; EC=571 uS; and T= 11.7 degrees Celsius.

WENCK

now part of

Stantec

Project:	Woodward	Well Name:	WW-2A
Location:	44.349494°, -120.891692°	Drilling Method:	Sonic
Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
Date started:	1/18/2021	Total depth:	30 Ft.
Date completed:	1/18/2021	Elevation:	2930 Ft.



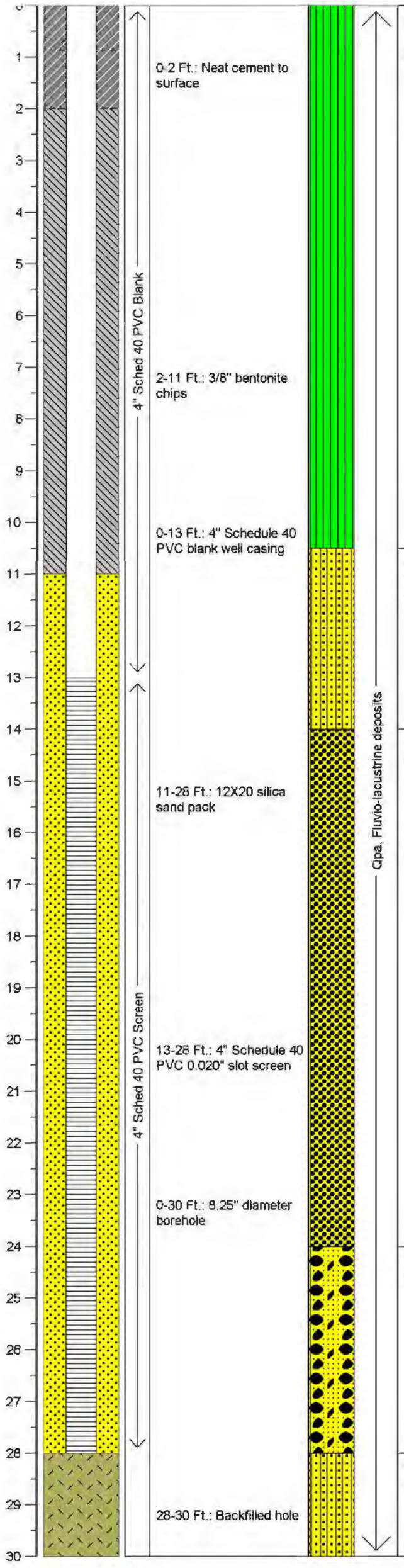
Well Construction	Lithology	Remarks
	0-6 Ft.: **SILTY SAND (SM)**: rooted from 0-1', moist form surface moisture, fine well sorted sand, medium plasticity, carbonate concretions at 2', silt is calcareous from 2-5', clay content increases below 2-5'	
	6-11 Ft.: **LEAN CLAY W/ SAND (CL):** moist at 6', platy, medium plasticity, carbonate leaching, trace fine sand, calcite content decreases below 5', coincides with fine sand increase between 5-7', increases again between 10-11', platy carbonate concretions	Water level measured at 21.35 feet bgs on 1/21/2021.
	11-14 Ft.: **SILTY SAND (SM):** low plasticity, non calcareous, granular, moist, fine to medium grained sand, silt between 12-13', decreases below 13'	
	14-17 Ft.: **POORLY GRADED SAND W/ GRAVEL (SP)** moist, granular, nonplastic, noncohesive, medium grained sand, gravel content 10-15% between 14-15', 0.5-1" diameter, gravel decreases from 15-16'	
	17-19 Ft.: **SANDY SILT (ML):** moist, calcareous, medium plasticity, cohesive, some trace gravel, trace roots, massive	
	19-24 Ft.: **POORLY GRADE SAND W/ GRAVEL (SP):** D.O. as 14-17', gravel content low from 20-21.5', noncalcareous	
	24-26 Ft.: **WELL GRADED GRAVEL W/ SAND (GW):** medium to coarse sand, trace silts, gravel betwene 0.5-3" in diameter, well rounded, wet, sharp contact with unit below	
	26-30 Ft.: **SILTY SAND (SM):** wet, medium to low plasticity, cohesive, noncalcareous, clay content increases with depth, prismatic, sand is fine grained and well sorted	

Notes: This figure presents the as-built details for WW-2A located near Knife River's Woodward Property in the SESE of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for two hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.58; EC=598 uS; and T= 13.1 degrees Celsius.

CROO 55019

now part of Stantec

Project:	Woodward	Well Name:	WW-3A
Location:	44.349629°, -120.891684°	Drilling Method:	Sonic
Drilled by:	Yellow Jacket Drilling Services	Logged by:	F. Tremblay
Date started:	1/20/2021	Total depth:	30 Ft.
Date completed:	1/20/2021	Elevation:	2929 Ft.



Well Construction	Lithology	Remarks
	0-11 Ft.: **SILT W/ SAND (ML):** overburden, rooted and moist with some organic content to 1.5', fine well sorted sand, clay content increases below 6', moist at contact	
	11-14 Ft.: **SILTY SAND (SM)**: fine to medium grained sand with occasionally calcareous silt, semiconsolidate, trace amounts of gravel <1cm in diameter, some carbonate concretions	Water level measured at 17.5 feet bgs on 1/21/2021.
	14-24 Ft.: **POORLY GRADED SAND W/ GRAVEL (SP):** moist, granular, coarsens with depth, nonplastic and noncohesive, medium grained well sorted sand, gravel is 0.5-1" in diameter, some medium plasticity sandy silt zones from 19-20'	
	24-28 Ft.: **WELL GRADED GRAVEL W/ SAND (GW):** medium to coarse grained sand, trace silt, well rounded poorly sorted gravel, 0.5-3.5" in diameter	
	28-30 Ft.: **SILY SAND (SM):** fine grained well sorted sand in silt, wet, blocky, well consolidated, noncalcareous, clay content increases with depth	

Notes: This figure presents the as-built details for WW-3A located near Knife River's Woodward Property in the SESE of Section 14 of T14S, R15E. This well was drilled and completed by Yellow Jacket Drilling Services of Sandy, OR using sonic drilling methods to assess shallow subsurface alluvial groundwater. Upon completion, the well was developed for 3 hours via surge block and pumping techniques. Water quality parameters at the end of development were as follows: pH=7.62; EC=338 uS; and T= 12.1 degrees Celsius.

Appendix B

Oregon EPA/DEQ Certified Laboratories Lab Certifications

Table B1. List of EPA and DEQ Certified Laboratories

Lab Name	ORELAP ID	Address	City	State	Zip	Phone	Email
2 River Labs Oregon	4112	2535 N. Ross Ave	Portland	OR	97227	503-493-2535	info@lightscale.com
Camp Rilea Laboratory	OR100059	33168 Patriot Way, Bld. 7239	Warrenton	OR	97146	9713554657	daniel.oldham@omd.oregon.gov
City of Bend Water Quality Laboratory	OR100038	22395 McGrath Rd	Bend	OR	97701	541-317-3017	cwhitman@bendoregon.gov
City of Corvallis Water Quality Laboratory	OR100027	1304 NE 2nd St	Corvallis	OR	97330	541-766-6720	john.hoppner@corvallisoregon.gov
Neilson Research Corporation	OR100016	245 South Grape St	Medford	OR	97501	541-770-5678	https://nrclabs.com/contact/
City of Portland Water Pollution Control Laboratory	4023	6543 North Burlington Avenue	Portland	OR	97203	503-823-5614	Jennifer.Shackelford@portlandoregon.gov
Clackamas Water Environment Services-Water Quality Laboratory	OR100053	15941 S. Agnes Ave., Bldg. B	Oregon City	OR	97045	503-557-2868	ebecker@clackamas.us
Portland Water Bureau Laboratory	OR100014	2010 N Interstate Ave	Portland	OR	97227	503-823-1829	marsha.farooqui@PortlandOregon.gov
SC Laboratories Oregon LLC	4133	15865 SW 74th Avenue, Suite 110	Tigard	OR	97224	503-272-8830	max.duimstra@sclabs.com

Source: Oregon Environmental Laboratory Accreditation Program

Oregon

Environmental Laboratory Accreditation Program

NELAP Recognized

Neilson Research Corporation

OR100016

245 South Grape St

Medford, OR 97501

IS GRANTED APPROVAL BY ORELAP UNDER THE 2016 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

Air	Drinking Water	Non-Potable Water	Solids & Chem. Waste	Tissue
	Chemistry	Chemistry	Chemistry	
	Microbiology	Microbiology		

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Oregon State Public Health Laboratory
ORELAP Program Manager
7202 NE Evergreen Parkway, Suite 100
Hillsboro, OR 97124

EFFECTIVE DATE : **12/24/2024**

EXPIRATION DATE : **12/23/2025**

Certificate No : **OR100016 - 032**